Universities Quarterly

VOLUME 10 · NUMBER 4 · AUGUST 1956

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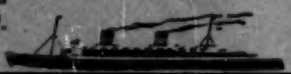

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Universities Quarterly

UNIVERSITY COMMENTARY

J. S. FULTON
Principal, University College of Swansea

It is possible to conceive of the bulge in the school population going all the way up to the sixth forms and yet leaving the universities largely unaffected. Universities bent on creaming off only a fixed number of the very ablest of the boys and girls leaving school could afford to be indifferent to fluctuations, however violent, in the number of unsuccessful applicants for places. Fortunately, the universities of this country have never regarded such a policy as a proper one to follow. The country's need of graduates to teach in the schools; to fill posts in public administration and in industry; to man the social services; to supply scientific and technical manpower to the under-developed countries, which is an inescapable duty of the great power of the twentieth century; above all, the recognition that over and beyond the production of scholars, the universities have nowadays the duty of educating a great number of others – especially those who need a very high education in science – who would be unable without a university education to learn the skills through which they are going to serve society; all these are grounds for seizing the opportunity, which the increased supply of potential students in the 'sixties will offer of taking a new step forward comparable to the expansion that has already taken place since the war. No responsible person can close his eyes to the difficult problems which such an expansion will raise, problems of building and – perhaps still more testing – problems of providing teaching staff.

In the meantime, it is comforting to know from two most reliable and representative authorities that the greater intake since the war is proving a sound investment for the universities and for the country. Sir Maurice Bowra and Sir Charles Morris recently wrote articles in *The Times* dealing with the students at Oxford and at Leeds. Both found grounds for feeling encouraged by what is being done, not only for the men and women of the highest ability, but for the great bulk

of those of less conspicuous academic abilities who have been the largest element in the post-war expansion. To quote the Vice-Chancellor of Leeds:

> Every university is turning out each year a large and increasing number of young men and women who have shown enough intellectual ability to stay and benefit from their courses and who will do well in their working lives and give good service to the country.

Distribution

When all the extra students of the 'sixties are flesh and blood candidates for admission rather than mere percentages on the planning papers of Senate and Council Committees, how are they to be distributed among the universities? Will the extra applicants who ought to be admitted just fit into the extra places to be provided by university building between now and 1962? Will it all work out right if the initiative, as now, is left to the student; and if he accepts what he judges to be the best offer – in terms of his order of preference – he is likely to get from the universities to which he has applied? Or, how will it be done? Shall we have again to consider the 'clearing house' idea, or will private compacts between individual universities have a part to play? What seems clear is that places provided at great public expense must not be allowed to stand empty in any university while candidates whose abilities are worth a place are unsuccessful elsewhere. No doubt the Glass enquiry will tell us much about the relationship in the past between vacancies and candidates which will help in deciding these questions.

New Colleges

The proposal for a new University College at Brighton has got off to a good start in the present favourable state of opinion about the expansion of student numbers. But it received a cool reception from *The Times Educational Supplement* which questioned the wisdom of founding a new institution until all the present smaller universities and university colleges have been brought up to a size of approximately 5,000. It did not appear to be arguing against the Brighton proposal on the ground that it would be a dispersal of scarce re-resources; or that institutions already founded could more quickly bring into productive use the resources a new institution would require. It argued, in general, against the smaller institution. Is there still a case for the small university – one much smaller than the size

to which the older civic universities have grown or are planned to grow?

No doubt it is true that the very small institution – whatever its merits as a social unit – lacks something very important for a university namely diversity and range of professional interest among its senior members. Grant that the ratio of teachers to taught must be fairly uniform throughout the university system; grant too that a small college or university must give preference to the bread and butter departments, those providing the staple diet of any university curriculum, over those of a more exotic academical flavour; it follows that the small institution must to some degree suffer from the lack among its members of scholars expert in the by-ways of university studies, often the growing points of new learning. But double the number of students in the small institution and the extra staff which go with them need not all be appointed in the bread and butter subjects. At least a proportion can be brought in to serve new and exciting branches of study hitherto excluded.

If there is anything in this argument, it seems to push the ideal size of the university upwards at a rate which at least keeps pace with the development of new ideas in the arts and sciences. But if the ordinary undergraduate is placed in an institution of more than a certain size he is in the gravest danger of losing himself in the crowd, of finding no social or academic bearings during his short span as a student. This surely is a weighty argument. Perhaps we may agree with the commentator in the *Educational Supplement* that there is no ideal size of a university, but surely we need not agree with him that nothing less than 5,000 will do.

St. Catherine's Society

One of the remarkable changes to which Sir Maurice Bowra referred in his article on students at Oxford since the war is the absence of the very poor student. St. Catherine's Society was founded to enable such a one to gain some of the advantages of Oxford at less than the cost which residence in a college demanded. Now that that need has gone, it is to St. Catherine's Society that the university is turning to provide a measure of expansion in undergraduate numbers without pressing too heavily on the capacity of the existing colleges. The signs of the time are visible here also for it is proposed that the new college will have as much as 50 per cent or perhaps more of its student body reading science. Some outside comment has been

critical of Oxford's response to the scientific challenge of our time. But the proposal seems a sensible answer to a difficult question. It may, however, be well from time to time to reflect how much the universities as a whole owe to Oxford's maintenance of its tradition as a predominantly Arts University. True balance in a university surely is not achieved by the mere counting of heads either of students or of members of Faculty. It depends rather on a balance in the respect which each of the great disciplines willingly gives and receives from the others and upon the influence which each exercises on the minds of every undergraduate during his university career. Oxford's great position in the world of universities and its devotion to the Arts have done much to protect Arts Faculties in universities less well placed, to prevent them from being overwhelmed in the scientific flood. In the long run this may well prove to be of decisive importance.

Student Ideals

There was recently published in *The Times* what their Correspondent writing from Edinburgh described as a revealing picture of the sort of university the students would like to see established in the Scottish capital. While the document has its own domestic purpose and interest upon which it would be improper to comment, the students' criticism of compulsory lectures and their advocacy of an extension of the tutorial system based upon essay writing prompts an inquiry into the advantages which the tutorial system is supposed to possess. In general it can be said to have three great merits which the lecture system lacks. First, by employing the essay as a technique of teaching, it forces the student to make the running in writing about the great problems of his subject. Week after week it drives him to wrestle with and to express on paper his own ideas, to sort them out, and if he cannot sort them out to recognize the precise point over which he is stuck. Second, having identified his difficulties he takes them to a senior member of the university and gets help in overcoming them. This in itself can be of immense importance in establishing the right kind of relationship between the junior and the senior members of a university. Third, it dictates a timetable. Whatever the length of the interval between essays, it is a regular one, and ensures that the student throughout his career will apply his efforts steadily and in the most economical way to the great mind-forming problems of his subject. This is the best and the only right preparation for examinations as it is for mastery over the subject. It has the related advantage

of preventing a student from delaying his attack upon these great problems until the last stages of his course, when for so many it proves too much to crowd into too short a time.

The tutorial system has in the past been associated with the colleges of the ancient universities. Many departments in the modern universities use the method of the essay in teaching their honours students, and the laboratory departments have their own means of putting the ball in the undergraduate's court. But it can hardly be doubted that to introduce the student to the compulsion of expressing his own ideas on paper from the very beginning of the course would be of immense value in developing his intellectual initiative. Could it be done in the existing departments? If, as seems likely, there must be many more halls of residence to help to house the increased student numbers of the 'sixties, could the tutorial-essay system be made their responsibility?

SCIENCE AND HUMAN VALUES

2. *The Habit of Truth*

J. BRONOWSKI
Director of the National Coal Board
Central Research Establishment

IN MY first essay I set out to show that there exists a single creative activity, which is displayed alike in the arts and in the sciences. It is wrong to think of science as a mechanical record of facts, and it is wrong to think of the arts as remote and private fancies. What makes each human, what makes them universal is the stamp of the creative mind.

I found the act of creation to lie in the discovery of a hidden likeness. The scientist or the artist takes two facts or experiences which are separate; he finds in them a likeness which had not been seen before; and he creates a unity by showing the likeness.

The act of creation is therefore original; but it does not stop with its originator. The work of art or of science is universal because each of us re-creates it. We are moved by the poem, we follow the theorem because in them we discover again and seize the likeness which their creator first seized. The act of appreciation re-enacts the act of creation; and we are (each of us) actors, we are interpreters of it.

My examples were drawn from physics and from poetry, because these happen to be the works of man which I know best. But what is great in these is common to all great works. In the museum at Cracow there is a painting by Leonardo da Vinci called 'The Lady with the Stoat': it shows a girl holding a stoat in her arms. The girl was probably a mistress of Ludovico Sforza, the usurper of Milan, at whose court Leonardo lived from about 1482 to 1499, amid the violence and intrigue which all his life drew him and repelled him together. The stoat was an emblem of Ludovico Sforza, and is probably also a pun on the girl's name. And in a sense the whole picture is a pun, if I may borrow for the word the tragic intensity which Coleridge found in the puns of Shakespeare. Leonardo has matched the stoat in the girl. In the skull under the long brow, in the lucid eyes, in the stately, brutal, beautiful and stupid head of the girl, he has re-discovered the animal nature; and done so without

malice, almost as a matter of fact. The very carriage of the girl and the stoat, the gesture of the hand and the claw, explore the character with the anatomy. As we look, the emblematic likeness springs as freshly in our minds as it did in Leonardo's when he looked at the girl and asked her to turn her head. 'The Lady with the Stoat' is as much a research into man and animal, and a creation of unity, as is Darwin's *Origin of Species*.

So much may be granted; and yet where is it to stop? The creative act is alike in art and in science; but it cannot be identical in the two; there must be a difference as well as a likeness. For example, the artist in his creation surely has open to him a dimension of freedom which is closed to the scientist. I have insisted that the scientist does not merely record the facts; but he must conform to the facts. The sanction of truth is an exact boundary which encloses him, in a way in which it does not constrain the poet or the painter. Shakespeare can make Romeo say things about the look of Juliet which, although they are revealing, are certainly not true in fact.

> O she doth teach the Torches to burne bright.
>
> But soft, what light through yonder window breaks?
> It is the East, and *Juliet* is the Sunne.

And Shakespeare himself is aware that these statements differ from those made by exact observers. For he exploits the difference deliberately for a new poetic effect in the sonnet which begins, tartly:

> My Mistres eyes are nothing like the Sunne.

This takes its point and pungency from being unpoetic. Shakespeare designedly in this sonnet plays the finicking scientist straight-faced –

> Currall is farre more red, then her lips red,
> If snow be white, why then her brests are dun

– in order to say at last, overwhelmingly, that even in plain fact his love is unbounded. No doubt Shakespeare would have been willing to argue in other places that the poetic image can be called true: the parable of the Prodigal Son is true in some sense, and so is the pursuit of Orestes, and the imagery of *Romeo and Juliet* itself. But the sonnet proves that Shakespeare did not think this meaning of truth to be the same as that which he met in Holinshed's *Chronicles* and William Gilbert's *De Magnete*, and which now dogs the writer of a thesis on electronic networks.

We cannot shirk the historic question, What is truth? On the contrary: the civilization we take pride in took a new strength on the day the question was asked. It took its greatest strength later from Renaissance men like Leonardo, in whom truth to fact became a passion. The sanction of experienced fact as a face of truth is a profound subject, and the mainspring which has moved our civilization since the Renaissance.

Those who have gone out to climb in the Himalayas have brought back, besides the dubious tracks of Abominable Snowmen, a more revealing model of truth. It is contained in the story which they tell of their first sight of some inaccessible and rarely seen mountain. The western climbers, at home with compass and map projection, can match this view of the mountain with another view seen years ago. But to the native climbers with them, each face is a separate picture and puzzle. They may know another face of the mountain, and this face too, better than the stranger; and yet they have no way of fitting the two faces together. Eric Shipton describes this division in the account of his reconnaissance for the new route to Everest, on which the later ascent in 1953 was based. Here is Shipton moving up to a view of Everest from the south which is new to him, but which his leading Sherpa, Angtarkay, had known in childhood.

> Beyond the village of Pangbochi we left the forest behind and entered highland country of heath and coarse grass. We spent the night of the 26th at Phariche, a grazing village then deserted, and on the morning of the 27th we turned into the Lobujya Khola, the valley which contains the Khombu Glacier (which flows from the south and south-west side of Everest). As we climbed into the valley we saw at its head the line of the main watershed. I recognised immediately the peaks and saddles so familiar to us from the Rongbuk (the-north) side: Pumori, Lingtren, the Lho La, the North Peak and the west shoulder of Everest. It is curious that Angtarkay, who knew these features as well as I did from the other side and had spent many years of his boyhood grazing yaks in this valley, had never recognised them as the same; nor did he do so now until I pointed them out to him.

It is the inquisitive stranger who points out the mountains which flank Everest. The Sherpa then recognizes the shape of a peak here and of another there. The parts begin to fit together; the puzzled man's mind begins to build a map; and suddenly the pieces are snug, the map will turn around, and the two faces of the mountain are

both Everest. Other expeditions in other places have told of the delight of the native climbers at such a recognition.

All acts of recognition are of this kind. The girl met on the beach, the man known long ago, puzzle us for a moment and then fall into place; the new face fits on to and enlarges the old. We are used to make these connections in time; and like the climbers on Everest, we make them also in space. If we did not, our minds would contain only a clutter of isolated experiences. By making such connections we find in our experiences the maps of things.

There is no other evidence for the existence of things. We see the left profile of a man and we see the right profile; we never see them together. What are our grounds for thinking that they belong to one man? What are the grounds for thinking that there is such a thing as the one man at all? By the canons of classical logic, there are no grounds: no one can deduce the man. We infer him from his profiles as we infer that the evening star and the morning star are both the planet Venus: because it makes two experiences cohere, and experience proves it to be consistent. Profiles and full face, back and front, the parts build a round whole, not only by sight but by the exploration of the touch and the ear, and the stethoscope and the X-ray tube and all our elaborations of inference. Watch a child's eyes and fingers together discover that the outside and the inside of a cup hang together. Watch a man who was born blind and who can now see, re-building the touched world by sight; and never again think that the existence of a thing leaps of itself into the mind, immediate and whole. We know the thing only by mapping and joining our experiences of its aspects.

The discovery of things is made in three steps. At the first step there are only the separate data of the senses: we see the head of the penny, we see the tail. It would be mere pomp to use words as profound as true and false at this simple step. What we see is either so or is not so. Where no other judgement can be made, no more subtle words are in place.

At the second step, we put the head and the tail together. We see that it makes sense to treat them as one thing. And the thing is the coherence of its parts in our experience.

The human mind does not stop there. The animal can go as far as this: an ape will learn to recognize a cup whenever and however he sees it, and will know what to do with it. But all that has been

learned about apes underlines that they find it hard to think about the cup when it is not in sight, and to imagine its use then. The human mind has a way of keeping the cup or the penny in mind. This is the third step: to have a symbol or a name for the whole penny. For us the thing has a name, and in a sense is the name: the name or symbol remains present, and the mind works with it, when the thing is absent. By contrast, one of the difficulties which the Sherpas have in seeing Everest is that the mountain goes by different names in different places.

The words true and false have their place at the latter steps, when the data of the senses have been put together to make a thing which is held in the mind. Only then is it meaningful to ask whether what we think about the thing is true. That is, we can now deduce how the thing should behave, and see whether it does so. If this is really one mountain, we say, then the bearing of that landmark should be due east; and we check it. If this is a penny, then it should be sensible to the touch. This is how Macbeth tests the thing he is thinking about and seems to see.

> Is this a Dagger, which I see before me,
> The Handle toward my Hand? Come, let me clutch thee –

Macbeth is using the empirical method: the thing is to be tested by its behaviour.

> Come, let me clutch thee:
> I haue thee not, and yet I see thee still.
> Art thou not fatall Vision, sensible
> To feeling, as to sight? or art thou but
> A Dagger of the Minde, a false Creation?

'A Dagger of the Minde, a false Creation'; both the word false and the word creation are exact. What the human mind makes of the sense data, and thinks about, is always a created thing. The construction is true or false by the test of its behaviour. We have constructed the thing from the data; we now deduce how the thing should behave; and if it does not, then our construction was false.

I have described so far how we think about things. The view I have put forward also looks beyond things, to the laws and concepts which make up science. This is the real reach of this view: that the three steps by which man constructs and names a mountain are also the steps by which he makes a theory.

Recall the example of the work of Kepler and of Newton; the steps are there to be re-traced. The first step is the collection of data: here, astronomical observations. Next comes the creative step which Kepler took, which finds an order in the data by exploring likenesses. Here the order, the unity is the three laws by which Kepler described the orbit, not of this planet or of that, but simply of a planet.

Kepler's laws, however, put forward no central concept; and the third step is to create this concept. Newton took this step when, at the centre of astronomy, he put a single activity of the universe: the concept of gravitation.

There is of course no such thing as gravitation, sensible to the touch. It is neither seen nor heard; and if it seems to be felt, this now appears to be a quirk of space. Yet the concept of gravitation was real and true. It was constructed from the data by the same steps which fuse two views of Everest into one mountain, or many conversations into one man. And the concept is tested as we test the man, by its behaviour: it must be in character. Newton was doing this in his garden in 1666 when he computed the force which holds the moon in her orbit; like Macbeth, he was testing the creation of the mind.

The creation was a concept – a connected set of concepts. There was the concept of a universal gravitation, reaching beyond the tree tops and the air to the ends of space. There was the concept of other universal forces in space, which try to pull the moon away as a whirling stone pulls away from its string. And there was the concept which put an end to the four elements of Aristotle: the concept of mass, alike in the apple and the earth and the moon, in all earthly and all heavenly bodies.

All these are real creations: they find a unity in what seemed unlike. They are symbols; they do not exist without the creation. Solid as it seems, there is no such thing as mass; as Newton ruefully found, it cannot be defined. We experience mass only as the behaviour of bodies, and it is a single concept only because they behave consistently.

Indeed, the concept of mass is a peculiarly apt example. For in the physics of Newton, there are two concepts of mass, which are distinct. One is the inertial mass of a body – that which must be overcome when it is thrown. The other is the gravitational mass of the same body – that which must be overcome when it is lifted from the ground. Newton knew, of course, that the inertial mass is equal

to the gravitational mass; but why are they equal, why should they be the same single mass? This is a question which Einstein asked; and in order to answer it, he built in 1915 the whole theory of General Relativity. Only in that theory were the two faces of mass made one, and made the unity which is the single concept, mass.

This sequence is characteristic of science. It begins with a set of appearances. It organizes these into laws. And at the centre of the laws it finds a knot, a point at which several laws cross: a symbol which gives unity to the laws themselves. Mass, time, magnetic moment, the unconscious: we have grown up with these symbolic concepts, so that we are startled to be told that man had once to create them for himself. He had indeed, and he has; for mass is not an intuition in the muscle, and time is not bought ready-made at the watchmaker's.

And we test the concept, as we test the thing, by its implications. That is, when the concept has been built up from some experiences, we reason what behaviour in other experiences should logically flow from it. If we find this behaviour, we go on holding the concept as it is. If we do not find the behaviour which the concept logically implies, then we must go back and correct it. In this way logic and experiment are locked together in the scientific method, in a constant to and fro in which each follows the other.

This view of the scientific method is not shared by all those who have thought about it. There are two schools of philosophy which are suspicious of conceptual thinking, and want to replace it wholly by the manipulation of facts. One is that offshoot of the English empiricist tradition which goes through Bertrand Russell to Wittgenstein and the logical positivists. This school holds that a rigorous description of all nature can be pieced together, like a gigantic tinker-toy, out of small units of fact, each of which can be separately verified to be so. The other is the school founded by Ernst Mach in Austria, and led more recently by Percy Bridgman in America, which holds that science is strictly an account of operations and their results. This behaviourist school would like to discard all models of nature, and confine itself always to saying that if we do *this*, we get a larger measurement than if we do *that*.

These accounts of science seem to me mistaken, on two counts. First, they fly in the face of the historical evidence. Since Greek times and before, lucid thinkers and indeed all men have used such words

as space and mass and light. They have not asked either Russell's or Bridgman's leave, yet what they have done with the words belongs to the glories of science as well as philosophy; and it is late in the day to forbid them this language.

And second, both schools fly in the face of the contemporary evidence. We have good grounds to believe, from studies of animals and men, that thinking as we understand it is made possible only by the use of names or symbols. Other animals than man have languages, in Bridgman's sense; for example, bees signal to one another where to go in order to find nectar. Bernard de Mandeville, who wrote *The Fable of the Bees* in an eighteenth-century parable, would have thought this the height of rational behaviour. But no active scientist sees it so, because he knows that science is not something which insects or machines can do. What makes it different is a creative process, the exploration of likenesses; and this has sadly tiptoed out of the mechanical worlds of the positivists and the operationalists, and left them empty.

The world which the human mind knows and explores does not survive if it is emptied of thought. And thought does not survive without symbolic concepts. The symbol and the metaphor are as necessary to science as to poetry. We are as helpless today to define mass, fundamentally, as Newton was. But we do not therefore think, and neither did he, that the equations which contain mass as an unknown are mere rules of thumb. If we had been content with that view, we should never have learned to turn mass into energy. In forming a concept of mass, in speaking the word, we begin a process of experiment and correction which is the creative search for truth.

In the village in which I live there is a pleasant doctor who is a little deaf. He is not shy about it and he wears a hearing aid. My young daughter has known him and his aid since she was a baby. When at the age of two she first met another man who was wearing a hearing aid, she simply said, 'That man is a doctor.' Of course she was mistaken. Yet if both men had worn not hearing aids but stethoscopes, we should have been delighted by her generalization. Even then she would have had little idea of what a doctor does, and less of what he is. But she would have been then, and to me she was even while she was mistaken, on the path to human knowledge which goes by way of the making and correcting of concepts.

I should be unjust if I did not grant that the positivist and opera-

tional schools of philosophy have had reason to be wary of the appeal to concepts. Russell and Bridgman shied away from the concept because it has a bad record, which still befuddles its use. Historically, concepts have commonly been set up as absolute and inborn notions, like the space and time which Kant believed to be ready-made in the mind. The view that our concepts are built up from experience, and have constantly to be tested and corrected in experience, is not classical. The classical view has been that concepts are not accessible to empirical tests. How many people understand, even today, that the concepts of science are neither absolute nor everlasting? And beyond the field of science, in society, in personality, above all in ethics, how many people will allow the sanction of experienced fact? The common view remains the classical view, that the concepts of value – justice and honour, dignity and tolerance – have an inwardness which is inaccessible to experience.

The roots of this error go down into the closed logic of the Middle Ages. The characteristic and distinguished example is the method of St. Thomas Aquinas. The physics which was current for three centuries before the Scientific Revolution derived from Aristotle by way of Arab scholars, and had been formed into a system by Aquinas. But it did not share the test of truth of modern physics. Between the years 1256 and 1259, Aquinas held about 250 discussion classes, all on the subject of truth. Each class lasted two days. The questions discussed belong to a world of discourse which simply has no common frontier with ours. They are such questions as 'Is God's knowledge the cause of things?' 'Is the Book of Life the same as predestination?' 'Do angels know the future?'

I do not dismiss these as merely fanciful questions, any more than I regard *Tamburlaine* and *The Marriage of Heaven and Hell* as fantasies. Yet it is plain that they have no bearing on matters of truth and falsehood as we understand them, inductively. These debates are scholastic exercises in absolute logic. They begin from concepts which are held to be fixed absolutely; they then proceed by deduction; and what is found in this way is subject to no further test. The deductions are true because the first concepts were true: that is the scholastic system. It is also the logic of Aristotle. Unhappily, it makes poor physics, for there the gap between the intuitive and the corrected concept is gaping.

Modern science also began by hankering after purely deductive

systems. Its first model, of course, was Euclid. One of its historic moments was the conversion of Thomas Hobbes, some time between 1629 and 1631.

> He was 40 yeares old before he looked on geometry; which happened accidentally. Being in a gentleman's library Euclid's Elements lay open, and 'twas the 47 El. libri I. He read the proposition. 'By G —,' sayd he, (He would now and then sweare, by way of emphasis) 'By G —,' sayd he, 'this is impossible!' So he reads the demonstration of it, which referred him back to such a proposition; which proposition he read. That referred him back to another, which he also read. *Et sic deinceps*, that at last he was demonstratively convinced of that trueth. This made him in love with geometry.

This account was written by John Aubrey, who was Hobbes's friend. Aubrey of course assumes that everyone knows which is the 47th proposition in the first book of Euclid; if we do not, we miss the explosive charge in the story. For the 47th proposition is the theorem of Pythagoras about the squares on the sides of a right-angled triangle – the most famous theorem of antiquity, for which Pythagoras is said to have sacrificed a hundred oxen to the Muses in thanks. Hobbes, in an age which knew the theorems by their numbers, at forty did not know the content of this; and when he learned it, it changed his life.

From then on, Hobbes became a pioneer of the deductive method in science. In his time, his innovation was necessary; but soon the movement of science left it behind. For when Hobbes took over the deductive method, he took also Euclid's notion that we know intuitively what points are, what an angle is, what we mean by parallel. The concepts and the axioms were supposed to be simply self-evident, in geometry or in the physical world.

Science has not stopped there since Hobbes, but such subjects as ethics have. In Hobbes's lifetime, Spinoza presented his *Ethics* 'ordine geometrico demonstrate', proved in geometrical order. The book begins in the Euclidean manner with eight definitions and seven axioms. This is a modest apparatus with which to attack the universe, for even Euclid's geometry of the plane needs more than twenty axioms. But Spinoza tackles it bravely and indeed profoundly, and it is not his fault that after a time we come to feel that we are standing still. The geometrical system of ethics has exhausted its discoveries. It no longer says anything new; and worse, it can learn nothing new.

Here is the heart of the difference between the two ways in which

we order our lives. Both ways hinge on central concepts. In both we reason from the central concepts to the consequences which flow from them. But here the two ways divide. In the field of ethics, of conduct and of values, we think as Aquinas and Spinoza thought: that our concepts must remain unchangeable because they are either inspired or self-evident. In the field of science, four hundred years of adventure have taught us that the rational method is more subtle than this, and that concepts are its most subtle creations. A hundred and fifty years ago, Gauss and others proved that the axioms of Euclid are neither self-evident nor necessarily exact in our world. Much of physics since then, for instance in relativity, has been the re-making of a more delicate and a more exciting concept of space. The need to do so has sprung from the facts; and yet, how the new concepts have outraged our self-evident notions of how a well-mannered space *ought* to behave! Quantum mechanics has been a constant scandal because it has said that the world of the small scale does not behave entirely like a copy of the man-size world. Swift in *Gulliver's Travels* had remarked something like this back in 1726, and it ought no longer to shock us; but of course, Swift was a scandal too in his day.

Is it true that the concepts of science and those of ethics and values belong to different worlds? Is the world of *what is* subject to test, and is the world of *what ought to be* subject to no test? I do not believe so. Such concepts as justice, humanity and the full life have not remained fixed in the last four hundred years, whatever churchmen and philosophers may pretend. In their modern sense, they did not exist when Aquinas wrote; they do not exist now in civilizations which disregard the physical fact. And here I do not mean only the scientific fact. The tradition of the Renaissance is of a piece, in art and in science, in believing that the physical world is a source of knowledge. The poet as much as the biologist now believes that life speaks to him through the senses. But this was not always so: Paolo Veronese was reproved by the Inquisition in 1573 for putting the real world into a sacred painting. And it is not so everywhere now: the ancient civilizations of the East still reject the senses as a source of knowledge, and this is as patent in their formal poetry and their passionless painting as in their science.

By contrast, the sanction of experienced fact has changed and shaped all the concepts of men who have felt the Scientific Revolu-

tion. A civilization cannot hold its activities apart, or put on science like a suit of clothes – a workday suit which is not good enough for Sundays. The study of perspective in the Renaissance chimes with the rise of sensuous painting. And the distaste of painters for naturalism for fifty years now is surely related to the new structure which scientists have struggled to find in nature in the same time. A civilization is bound up with one way of experiencing life. And ours can no more keep its concepts than its wars apart in pigeonholes.

All this is plain once it is seen that science also is a system of concepts: the place of experience is to test and correct the concept. The test is, Will the concept work? Does it give an unforced unity to the experience of men? Does the concept make life orderly, not by edict but in fact?

Men have insisted on carrying this test into the systems of society and of conduct. What else cost Charles I his head in 1649? And what brought Charles II back in 1660, yet at last exiled his family for Dutchmen and Germans? Not the high talk about the divine right of kings, and not the Bill of Rights, but their test in experience. England would have been willing to live by either concept, as it has been willing to live by Newton or by Einstein: it chose the one which made society work of itself, without constraint.

Since then society has evolved a sequence of central concepts each of which was at one time thought to make it work of itself, and each of which has had to be corrected to the next. There was the early eighteenth-century concept of self-interest, in Mandeville and others; then came enlightened self-interest; then the greatest happiness of the greatest number; utility; the labour theory of value; and thence its expression either in the welfare state or in the classless society. Men have never treated any one of these concepts as the last, and they do not mean to do so now. What has driven them, what drives them is the refusal to acknowledge the concept as either an edict or self-evident. Does this really work, they ask, without force, without corruption and without another arbitrary superstructure of laws which do not derive from the central concept. Do its consequences fit our experience; do men in such a society live so or not so? This is the simple but profound test of fact by which we have come to judge the large words of the makers of states and systems. We see it cogently in the Declaration of Independence, which begins in the round Euclidean manner 'We hold these truths to be self-evident', but which takes the justification for its action at last from 'a long

train of abuses and usurpations': the colonial system had failed to make a workable society.

One example among others points the modern lesson. When Warren Hastings was impeached in 1786 for his high-handed rule in India, he had two grievances on his side. One was that the violence and corruption of which he was accused were in any case commonplace throughout Indian society then. The other was that some of his accusers (and chiefly Burke) were not free from a corrupt interest in Indian affairs themselves. Warren Hastings was acquitted, but not on these grounds, for they missed the difference between India then and Europe. Man as man had a different value in the two continents. The Renaissance had made the difference; and England with her dissenters had been evolving the new value for two hundred years, always by the downright test of making a stable and self-correcting society. The conduct of Warren Hastings was to be judged by the same aim, and by no other; the standards of lesser societies ruled by conquerors, the motives of lesser men had no bearing on it.

The cultures of the East still differ from ours as they did then. They still belittle man as individual man. Under this runs an indifference to the world of the senses, of which the indifference to experienced fact is one face. Anyone who has worked in the East knows how hard it is there to get an answer to a question of fact. When I had to study the casualties from the atomic bomb in Japan at the end of the war, I was dogged and perplexed by this difficulty. The man I asked, whatever man one asks, does not really understand what one wants to know: or rather, he does not understand that one wants to know. He wants to do what is fitting, he is not unwilling to be candid, but at bottom he does not know the facts because they are not his language. These cultures of the East have remained fixed because they lack the language and the very habit of fact.

To us, the habit of simple truth to experience has been the mover of civilization. The last war showed starkly what happens to our societies and to us as men when this habit is broken. The occupation of France forced on the people of France a split in the conduct of each man: a code of truth to his fellows, and a code of deceit to the conquerors. This was a heroic division, more difficult to sustain than we can know, and for which the world has still to thank Frenchmen. Yet those who lived in that division will never wholly recover from

it, and the habits of distrust and withdrawal which it created will long hamstring the free life of France and of Europe.

This is the grave indictment of every state in which men are cautious of speaking out to any man they meet. The decay of the habit of truth is damaging to those who must fear to speak. But how much more destructive, how degrading it is to the loud-mouthed conquerors. The people whom their conquests really sapped were the Nazis themselves. Picture the state of German thought when Werner Heisenberg was criticized by the S.S., and had to ask Himmler to support his scientific standing. Heisenberg had won the Nobel prize at the age of thirty; his principle of uncertainty is one of the two or three deep concepts which science has found in this century; and he was trying to warn Germans that they must not dismiss such discoveries as relativity because they disliked the author. Yet Himmler, who had been a schoolmaster, took months of petty inquiry (someone in his family knew Heisenberg) before he authorized of all people Heydrich to protect Heisenberg. His letter to Heydrich is a paper monument to what happens to the creative mind in a society without truth. For Himmler writes that he has heard that Heisenberg is good enough to be earmarked later for his own Academy for *Welteislehre*. This was an Academy which Himmler proposed to devote to the conviction which he either shared with or imposed on his scientific yes-men, that the stars are made of ice.

This nonsense of course is like the nonsense that Germans were taught to credit about the human races. The state of mind, the state of society is of a piece. When we discard the test of fact in what a star is, we discard it in what a man is. A society holds together by the respect which man gives to man; it fails in fact, it falls apart into groups of fear and power, when its concept of man is false. We find the drive which makes a society stable at last in the search for what makes us men. This is a search which never ends: to end it is to freeze the concept of man in a caricature beyond correction, as the societies of caste and master-race have done. In the knowledge of man as in that of nature, the habit of truth to experienced fact will not let our concepts alone. This is what destroyed the empires of Himmler and of Warren Hastings. When Hastings stood his trial, William Wilberforce was rousing England to put an end to the trade in slaves. He had at bottom only one ground: that dark men are men. A century and more of scientific habit by then had made his

fellows find that true, and find Hastings not so much a tyrant as a cheat.

There have always been two ways of looking for truth. One is to find concepts which are beyond challenge, because they are held by faith or by authority or the conviction that they are self-evident. This is the mystic submission to truth which the East has chosen, and which dominated the axiomatic thought of the scholars of the Middle Ages. So St. Thomas Aquinas holds that faith is a higher guide to truth than knowledge is: the master of medieval science puts science firmly into second place.

But long before Aquinas wrote, Peter Abelard had already challenged the whole notion that there are concepts which can only be felt by faith or authority. All truth, even the highest, is accessible to test, said Abelard: 'By doubting we are led to enquire, and by enquiry we perceive the truth.' The words might have been written five hundred years later by Descartes, and could have been a recipe for the Scientific Revolution. We have the same dissent from authority in the Reformation; for in effect what Luther said in 1517 was that we may appeal to a demonstrable work of God, the Bible, to override any established authority. The Scientific Revolution begins when Copernicus put forward the bolder proposition that there is another work of God to which we may appeal even beyond this: the great work of nature. No absolute statement is allowed to be out of reach of the test, that its consequence must conform to the facts of nature.

The habit of testing and correcting the concept by its consequences in experience has been the spring within the movement of our civilization ever since. In science and in art and in self-knowedge we explore and move constantly by turning to the world of sense to ask, Is this so? This is the habit of truth, always minute yet always urgent, which for four hundred years has entered every action of ours; and has made our society and the value it sets on man, as surely as it has made the linotype machine and the scout knife, and *King Lear* and the *Origin of Species* and Leonardo's 'Lady with the Stoat'.

THE UNIVERSITIES AND THE GENE ETHIC

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Homo liber nulla de re minus quam de morte cogitat; et ejus sapientia non mortis sed vitae meditatio est.

SPINOZA's *Ethics*

TODAY WE have a new ethic, the gene ethic, which concerns our obligation to our fellow man of the future. In a sense we, the present generation, are, as Professor Muller[1] puts it 'but the trustees of the germplasm which belongs to the species as a whole and will be the heritage of our descendants'.

As our understanding of the mechanism of inheritance has increased, so also has our ability to release the forces which could upset this mechanism and destroy or distort the human race. Thus, it has become the duty of all men, and not just the 'chore' of a few experts, to know how to protect and preserve our hereditary capital – it is an ethical issue.

Undoubtedly the scientific discoveries of this century of greatest significance to man's future are the advances in the theory and practice of genetics. Yet, while the implications of rocket propulsion, atomic energy, electronics and automation, insulin and penicillin are universely appreciated, few even of the informed public realize that there is such a thing as hereditary substance, far less know anything of its nature or how it is handed on from parent to progeny.

Applied genetics has already provided at least some of the answers to the problem of feeding the two-thirds of the world population unable to get enough to eat and promises a measure of control of plant and animal disease, but it is as the vital force determining the form of living things and the evolution of those qualities of body and mind which distinguish man and shape our societies that some understanding of the laws of heredity are today as essential to the educated man as the knowledge of the history and geography of his own land.

[1] This article has borrowed freely from the contributions by Professor Westergaard and Professor Muller in the *Bulletin of the Atomic Scientists*, Vol. II, No. 9, 1955.

The basic structural and functional concepts of inheritance are incorporated in the gene-chromosome theory. The units of hereditary substance are the genes, arranged in longitudinal sequence to form a number of thread-like chromosomes which are packed into the centre spot, or nucleus, of the cells forming the tissues and organs of the body, that is into an area with a diameter of less than 1/500 of a millimetre. Each gene occupies a definite situation in a specific chromosome and the chromosomes are arranged in pairs, one from each parent, in such a way that the corresponding genes are also paired off. The number of chromosomes, and therefore genes, is the same in all the nuclei of the body cells of individuals of the same species. In man there are twenty-four pairs of chromosomes carrying two sets of genes (approximately 40,000 genes) in each cell nucleus.

The sex cells, the spermatozoa and ova, have only one set of genes forming twenty-four chromosomes. When the sex cells are formed by division of stem cells the paired chromosomes separate, one from each pair to a sex cell and with the union of spermatozoa and ova at fertilization the chromosome sets pair off again. The genes work in pairs, the gene of one chromosome having its counterpart or allele in the gene of the other chromosome of the pair. The two allelic genes which a child receives, one from each parent, do not necessarily express themselves equally, one may be dominant and the other recessive when the result is not the mean but the expression of the dominant gene. Where one dominant and one recessive gene are alleles half the sex cells will receive the dominant gene and the other half the recessive gene. With twenty-four pairs of allelic genes all separating into different sex cells the very large number of possible combinations will ensure that no two sex cells are exactly alike with regard to hereditary substance. This is expressed in the differences between the progeny of the same parents.

Genes do not 'produce' characters, but are biochemical states which when acted upon by environment, both inside and outside the organism, determine particular physical and mental qualities. The hereditary endowment of an organism, that is quantity and quality of the genes, is known as the genotype while their expression, as manifest in the living organism, constitutes the phenotype. The relative importance of hereditary substance and environment, that is of nature and nurture, varies according to the genes involved. The blood group of an individual is determined wholly genetically while the spoken language is largely environmental. The genotype however

limits the range and defines the potential of qualities. Environment for instance cannot make a European out of an Oriental or by itself create a musical genius.

It is the accepted ethics of the modern civilized nation that its people should be given the opportunity to develop the full potential of their genotype – the political right of man to freedom, security, food, shelter and education even although this has no effect on the nature of the hereditary substance passed on to the next generation. 'At the present level of genetic knowledge we cannot improve the genes with which we were born and there is little we can do to determine which genes we pass to our children, but we can improve the manifestation of our own genes and those of other persons so that the best possible is produced. The control of the manifestation of human genes is, of course, possible only by proper manipulation of the environment.'

If genotypes were identical then, in theory, there would be uniformity of living forms? in practice variability is necessary for the continued existence of life. Spontaneous changes in hereditary substance, known as mutations, occur for some reason or other in every generation. Such mutations are quite independent of any change in the individual nor do they affect the individual, but when they happen in the sex cells they are passed on to the next generation. Biological evolution, according to modern interpretation, is the interaction of these spontaneous mutations with the selective pressure of the environment. In a stable environment most spontaneous mutations are to the disadvantage of the descendants and can be regarded as responsible for qualitative deterioration of hereditary substance. They tend to produce 'unfit' phenotypes with a low survival rate finally to be eliminated by selection pressure. In a changing environment the mutations may produce some variation in the phenotype more adaptive to the new environment, that is with a high selective value and survival rate and in this way be retained as a new variant in form and function.

Every plant and animal population carries a proportion of mutated genes, the so-called genetic load, which, in a stable environment, is maintained in equilibrium by the balance of selective pressue which elimates the 'bad' genes and the spontaneous mutation rate. While such a genetic load confers plasticity on the population as a reserve of variation in the event of some change in the surroundings, at the same time it reduces the fitness in terms of adaptation to the existing

environment. For the most part the genetic load is carried by apparently normal phenotypes as mutated genes are usually recessive and so are not expressed, unless the progeny receives the same recessive gene from each parent which may then become manifest in the phenotype as physical deformities, mental defects or hereditary disease.

It is said that in man three out of every ten sex cells contain one spontaneous mutation per generation and it has been put as high as one mutation for ever sex cell, so that spontaneous mutations cannot be regarded as rare phenomena but as a relatively common biological event. Most of the spontaneous mutations in man are probably due to normal radiation (cosmic rays) and similar mutations can be induced by experimental ionizing radiation, for example – X-rays, radium and the radioactive products of nuclear fission. Ionising radiations consist of fast moving particles capable of penetrating through the tissues into the cell nuclei, where the encounter between the hereditary particle and the atomic particle can bring about a breakage of whole chromosomes or, if less severe, affect separate genes. As Professor Westergaard has pointed out, even self-illuminating watches, control panels of aircraft and television screens emit a certain amount of radiation which adds to the total quantity received during the life span of the sex cells. It is therefore, as he infers, a fair assumption that life in the twentieth century has brought about an increase in the mutation rate and that this is likely to continue. A recent report[1] has given some factual information on the medical and genetic aspects of ionising radiations including the long term effects of the 'fall out' of test explosions of nuclear weapons. What matters is the number of radiation induced mutations which are added to the population, and this is proportionate to the total radiation dose received by the sex glands of the parents of the next generation from birth to the end of the fertile years. The total radiation dose received by the sex glands from natural radiation can be calculated and other radiation hazards expressed as a percentage of such natural radiation doses. The report states:

> The inhabitants of this country may receive in the next 50 years, from nuclear weapons already exploded, about 0.02 per cent to 0.04 per cent of the radiation that they will receive during the same period from natural sources. If the firing of bombs were to continue indefinitely at

[1] The Hazards to Man of Nuclear and Allied Radiations. H.M.S.O. Publication.

the same rate as over the past few years, there would be a build-up of activity, gradually reaching a plateau in about a hundred years, which would give the average individual a dose over a period of 30 years of about 1 per cent of what he would receive in the same period from natural sources. The individual and genetic effects of such a dose of external radiation would be insignificant.

The most important radiation hazard of to-day is diagnostic X-ray examinations, which can add up to 22 per cent of the natural radiation dose and this may well be genetically significant and affect the mutation rate of a population. This particular hazard, as the report makes clear, could be reduced by the use of proper safe-guards. The following is a quotation from Professor Mather:

> There can certainly be nothing but genetic disadvantage for man in artificially raising his mutation rate, by irradiation or any other means, above that which has sufficed for his evolution up to the present. We must expect all the distressing hereditary conditions known in man to be increased in frequency by irradiation which reaches the reproductive organs. And in so far as the genetic effects of the radiation are cumulative, even the smallest doses applied at the lowest intensities will add their quota to such suffering and distress. The genetic effects may be long delayed: it may be hundreds of years before a recessive mutation makes itself visible phenotypically. Yet sooner or later the effects of even recessive mutations will be seen, for there is no going back in heredity. A mutation once produced cannot be undone: genetic murder will out. The fact that it may out only after many generations is no excuse for condoning it now.

Survivors of an atomic explosion who had been exposed to heavy doses of radiation could be affected in several ways.

Chromosome damage to a large number of the ordinary cells of the body can cause delayed effects from destruction of the tissues and organs of the individual exposed, e.g., when large numbers of blood-forming cells are destroyed, severe anaemias develop later. Of more importance to the nation, if not to the human race, are the effects on the hereditary substance of the sex cells. This might be:

a) Widespread chromosomal damage to the whole sex gland causing sterility of male or female.

b) Mature sex cells, i.e., those ready to be fertilized, are particularly sensitive to radiation. They may not be sufficiently damaged to prevent successful conception and apparently normal offspring, but a proportion of the sex cells of these offspring are defective and preg-

nancy in this first generation tends to terminate in abortion and miscarriage, a condition known as inherited abortion.

c) More localized damage to the hereditary substance causes a change in the state of a gene or a number of genes, and most of these mutations are harmful to the progeny, but, of course, have no effect on the individual at the time. The genes work in pairs and provided the progeny receive a normal gene from one of the parents, there are, as a general rule, no perceptible ill effects although the individual may be hampered in some way or another. If, however, similar mutated genes have been inherited from each parent so that there is a 'bad' pair, the progeny will show gross defects. This is much more likely to happen where a whole population has been subjected to a heavy dose of radiation with a consequent great increase in the total number of mutations in a community. Bad genes are responsible not only for hereditary defects but also for a pre-disposition to many diseases. The fact that normal children were born to survivors of Hiroshima and Nagasaki does not mean that the parents received no genetic damage for, although they may be dormant for many generations, every mutated gene represents a postponed disaster. The important thing is not the amount of harm done to the individual exposed, or even to the progeny who inherit mutations, but the total number of mutations as that is what will be passed on to succeeding generations.

The outstanding evolutionary product of the last 100,000 years is the human brain, which has enabled man to evolve a new method of survival by a process of adapting his environment to suit his own requirements and so modifying his own 'selection' pressure. His most recent achievement, the control of nuclear fission, surpasses in this respect his earlier inventions of fire and agriculture. It is this unique power to control his environment and so interfere with the bias of natural selection, together with his unwitting release of forces capable of causing a disastrous increase in the mutation rate that has stressed the urgency of a gene ethic transcending race, nationality, religion or political creed.

In civilized human communities the equilibrium of the genetic load has probably already been affected (only future generations can bear evidence) by the decrease in selective pressure and the increase in mutation rate. There are therefore two aspects of the gene ethic: our responsibility to the human phenotype and the human genotype, and the two are to some extent in conflict.

The modern welfare state spends much of its national income in social and medical services which ease the selection pressure on the biologically unfit and keep in circulation 'bad' genes which would not survive in a 'wild' population. It is inconceivable, however, that it should be otherwise. A policy of increased selection pressure directed towards the elimination of the unfit would require a renunciation of those ethical principles which are themselves an expresion of man's unique genetic heritage. Moreover, man owes his success in controlling his environment to his variability exceeding that of any other species, giving him his wide range of talents. In a civilized community there is no absolute measure of fitness and the physically defective or diseased may pass on genes to their progeny which enable them to make some outstanding contribution to human welfare. At any rate, it is doubtful if in a mixed breeding population such as man elimination of the unfit would make any worthwhile contribution to the human genotype, as a great proportion of recessive genes are carried by good physical and mental phenotypes.

There remains our responsibility to the genotype. There is no branch of science so remote from the 'public' as genetics and one of the disquieting features of the present situation is that very few of the scientists, technologists and technicians who will be in charge of our expanding atomic industry have even an elementary knowledge of genetics or appreciation of the potential danger to future generations of the mutations induced by the radioactivity they will control. Certainly there is the official 'permissible dose', but this is a formula designed to protect the exposed individual from harmful effects, immediate or delayed, and is irrelevant with regard to induced mutations of the sex cells. Even in universities it is the exception to find a member of staff in departments dealing with nuclear fission who would admit to a knowledge of any particles other than those produced by his experimental atoms.

By insisting that all those who may find themselves involved in industrial or experimental production of ionizing radiation should have instruction on the nature and simple laws of the gene-chromosome concept of inheritance, the universities could make a useful contribution to the new ethic. Indeed, it could be argued that no student should graduate from a university ignorant of the nature of the heritage of which he is but the temporary custodian.

HISTORY AND PHILOSOPHY OF SCIENCE

A Pioneer Department

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General Introduction

IN RECENT years the History and Philosophy of Science have begun to play an increasing part in university education both throughout the British Commonwealth and in the U.S.A. The new importance attached by historians to the history of science can be judged by contrasting Professor G. M. Trevelyan's *English Social History*, in which the influence of science is scarcely mentioned, with the views of a younger historian of comparable distinction, Professor Herbert Butterfield, who declares that the 'scientific revolution' of the sixteenth and seventeenth centuries 'outshines in importance everything since the rise of Christianity, and reduces the Renaissance and the Reformation to the rank of mere episodes, mere internal displacements, within the system of medieval Christianity'.

Many people nowadays feel not only that the History and Philosophy of Science are worth studying and teaching in their own right, as branches of history and philosophy, but that they also have an important part to play in a wider field of education, as elements in other undergraduate Arts and Science courses. It seems extraordinary to them that, in an age when science and scientific ideas play a dominant part in all our lives, students can still leave their universities for responsible positions in business and in public life, having been given what is called 'a liberal education', yet without having acquired any conception at all of scientific ways of thinking. (It is interesting to find Joseph Priestley, that great Leeds natural philosopher of the eighteenth century, complaining similarly at the failure of Oxford and Cambridge in his own time to provide a genuinely liberal education – by which he meant one in which the chief principles of science take their proper place alongside the classics). They find it almost equally surprising that our technically-trained students can think they are getting a comprehensive grasp of their own subjects, without coming to understand how these subjects reached

the form they have today, or how they are related to the other sides of human life.

Such weaknesses in twentieth-century university education are, of course, frequently remarked on. But they are too often made a subject only for laments in general terms. The trend towards undiluted specialization is taken to be something inevitable and irreversible, and no practical remedies are therefore looked for. But these particular weaknesses are far from irremediable. A fairly high degree of specialization is no doubt with us permanently, and is healthy enough; but Arts students can nevertheless learn something useful about scientific ways of thinking, if they are given the chance to study a few of the important scientific advances of the past in their historical settings. Science and engineering students, too, can acquire a more flexible and humane attitude towards their own specialities by learning to ask historical and logical questions about them. And both kinds of study are worth treating in serious and intensive academic courses, rather than as extra-curricula frills.

There are reasons, therefore, for thinking that the history and logic of the sciences make up a field of study with a key part to play in the campaign for a more balanced university education. This is why, during the last few years, so many universities have been experimenting with novel courses on History of Science, Philosophy of Science, Science and Civilization and similar topics. In this article I propose to discuss some of the problems which arise for anyone entering the field, and to describe one notable attempt to solve them – that being made in Australia at the University of Melbourne. There an autonomous department of 'History and Methods of Science' has been created, which has the task of dealing with the history and philosophy of science as a subject in its own right, and of providing courses in this field for arts, science, medicine and architecture students alike. By setting up such a department, I shall argue, the University of Melbourne has put itself in an uncommonly strong position, and its experience in this pioneering region of education should be of value to other universities planning to enter the field.

The unusual character of Melbourne's History and Methods of Science Department can best be understood by contrasting its work and organization with that to be found in other universities. In most universities, History of Science, Philosophy of Science and the like are treated as sidelines by the existing History, Philosophy, or Natural

Science Departments. In the U.S.A., for instance, more than a dozen of the leading universities run introductory General Science courses for first-year Arts students, a dozen have graduate courses in the History of Science, and more than a dozen include Philosophy of Science in their Philosophy courses. But it is a different dozen in each case, and even where both undergraduate and graduate courses exist, as at Harvard, their organization is usally independent. There are autonomous graduate schools at Harvard and John Hopkins, but (so far as my information goes) only at the University of Wisconsin is there a comprehensive History of Science Department, running undergraduate and graduate courses alike.

In the United Kingdom experiments in this field have been even more varied and sporadic. As a result of the emphasis on honours courses, one does not find anything comparable with an American first-year General Science course, but most universities are trying one thing or another. At Oxford, there is a lectureship in the Philosophy of Science attached to the Philosophy sub-Faculty, while an entirely independent History of Science lectureship is connected with the History of Science Museum: in neither subject are there regular courses or examinations. At Cambridge, 'History and Philosophy of Science' is included as an optional 'half-subject' in Part I of the Natural Science Tripos, and a separate Part II course is to be started. At University College, London, History of Science is taught as an evening course for the M.Sc. degree by their own Department of History and Methods of Science and notable research has been done by the staff of the department: meanwhile, entirely independent courses of lectures on Philosophy of Science and on Scientific Method are taught within the University College Philosophy and Physiology Departments, to say nothing of Professor K. R. Popper's courses on Logic and Scientific Method for Social Science students at the London School of Economics. At Aberdeen, there is a Reader in History of Science, whose post is endowed by Imperial Chemical Industries, and who gives open lectures for anyone who cares to come. Elsewhere, there are several courses on the Philosophy of Science, taught by members of Philosophy Departments to mixed audiences of Philosophy and Science students; and no doubt my list is far from complete.

To sum up: at least six different types of course can be found at one university or another in the English-speaking countries. Apart from (i) history of science within the normal history syllabus and

(ii) philosophy of science within the philosophy syllabus, one finds (iii) general science courses for Arts students, normally in the first year, (iv) supplementary courses in history and philosophy of science for students of science, medicine and engineering, normally in the second or third year, (v) supplementary courses in scientific method for honours students of economics and social science, and (vi) history or philosophy of science treated as a whole-time study by graduates in history, philosophy, science or medicine. Up to now, however, these experimental courses have been largely sporadic and un-co-ordinated: they have been started whenever and wherever somebody in a university was specially keen on one or another of them, and they have frequently had to stop again, owing to pressure of other work or the departure of the innovator elsewhere.

As a result, though many universities are attempting to supply one, or in some cases two of the different types of course, hardly anywhere is a systematic attempt being made to tackle them together: this remains the case, despite the fact that the subjects are generally recognized as important for the future of education both in the sciences and the humanities. Melbourne apart, one finds a fully-fledged department responsible for teaching both undergraduates and graduates only at the University of Wisconsin. Yet there is little doubt that, of the American experiments, the Wisconsin one is proving the most successful. 'Having an autonomous department', writes Professor Marshall Clagett, the Head of the Department, 'has made for a more independent consideration of and support to the subject of the History of Science by the University'; and a visitor who looked into the situation at some twenty-five universities in the U.S.A. was left with the strong impression that only at Wisconsin was the gap between the Science and Humanities Departments bridged with complete success.

Seen against this background, the organization of the History and Methods of Science Department at the University of Melbourne is of great interest, and perhaps a model for us all. Two constitutional weaknesses have often proved fatal to experiments in this field: firstly, the difficulty of keeping continuity – courses put on as sidelines or frills have a notorious tendency to expire for lack of effort and backing – secondly, the difficulty of organizing research and teaching on the History and Philosophy of Science in a way which keeps the respect of both the Arts and Science sides of a university. The experience of Melbourne and Wisconsin indicates that these difficulties are

most easily overcome by setting up an independent department whose members have first-hand experience in both the Natural Sciences and the Humanities: only an autonomous department is equipped to deal in a systematic way with the History, Methodology, and Philosophy of the Sciences. The point of view of students too must be considered. However warmly a university's staff may profess to feel about courses in this subject, students will remain sceptical so long as it is in fact treated as a pure extra. If Art or Arabic or Anthropology 'rates' a department, while the History and Philosophy of Science does not, no one can blame students for concluding that the university does not really take the subject seriously.

The Melbourne Experiment

To turn to the Melbourne department: before explaining the part which it plays in the university's courses, something brief must be said about its origins and staff. It is a post-war creation, the offspring of the Physiology Department on one side and of the History and Philosophy Departments on the other, and from the beginning it has had the job of teaching both medical or scientific students and arts students. The staff has included at one time or another people with very varied mixtures of qualifications: a meteorologist with a special taste for symbolic logic, two physicists with Honours Philosophy degrees, a physiologist who lectures on scientific method to medical students, a chemist with a history training, a botanist (married to a logician) with experience in the teaching of general science at the Sixth-Form level. Now you may ask: surely Melbourne have been exceptionally fortunate, in having such an unusual selection of people at hand to undertake this work? Perhaps they have been fortunate, but I do not think they have been exceptionally so: in and around most universities there will be found half-a-dozen people who have equipped themselves with similar combinations of qualifications or experience – usually through having the sort of native curiosity which is invaluable in a subject of this kind. Two things, however, *are* exceptional at Melbourne: first the vigour with which cross-faculty discussions are carried on in any case, and secondly the organization, which encourages people to make what started as a side-interest their primary occupation, and to apply themselves full time to the task of building up techniques and traditions of teaching suited to the different classes of student coming to them.

(A) Let me say something about the two chief Melbourne courses in turn. The most extensive and patronized course is the one for Arts students, known as History and Methods of Science 'A'. This corresponds roughly to the American first-year General Science courses, but whereas American courses tend to contain an ideological element – emphasizing, for instance, parallels between scientific procedure and the democratic way of life – it has always been the aim of the H.M.S. 'A' course to be more intensive.

A word is needed about its place in the examination system. At Melbourne, as at some other universities, the course for the ordinary B.A. degree has to include one first-year science subject, occupying a fourth part of a year's work. This science subject can be Botany I, say, or Psychology I: alternatively it can be H.M.S. 'A'. For an Arts student, a straight first-year science course has disadvantages: it is normally designed to meet the needs of a very different class of students, who will be going on to read more of the same science. It too often, therefore, introduces one only to the rudiments and most elementary techniques of the science, instead of giving a broad survey of its nature and problems. Many Arts students must as a result have gone away from their science course with a cruelly false impression of the scientist as a man preoccupied with calorimeters, fume-chambers, or the anatomy of the frog.

The H.M.S. 'A' course, by contrast, is worked out specifically for Arts students and is self-contained. It deals in the three terms of the year with the historical and methodological development of our ideas about living creatures, about the structure of matter, and about dynamics and astronomy. The plan of the course is, to take the chief historical advances in each field and try to show three things about them: (i) what the problems were to which they provided a solution, (ii) what was the nature of the steps by which the change in ideas was brought about, and (iii) in just what ways the world appeared different both to scientists and to people at large as a result of the new advances. To see the world through the eyes of an Aristotelian, and then to recognize how from the thirteenth to the seventeenth centuries people gradually came to change their picture of things, and at what point exactly the Galilean revolution impinged on their ideas: this is the sort of thing which can help the non-scientist to get a proper feeling for the nature and methods of science and the place it occupies in our lives.

Three lectures a week are provided, and the audience is also

broken up into groups for a weekly tutorial-cum-demonstration and a fortnightly discussion. A fair amount of private reading and of written work are also required: students produce at least one essay a term as well as a fifteen-minute paper to open one of the fortnightly discussions. The demonstrations are a most important part of the course. Lectures are all very well, but the real feel of a science comes only when one can actually handle its subject matter and its instruments: it is essential that Arts students should be given a live view of the subject, instead of having the printed page always coming between them and it.

Several kinds of demonstration are called for. Using a microscope for the first time, and having to describe what (if anything) one can descry through it, or being presented with a dissected-out rat or snail and required to trace out the connections of its unlabelled organs: these are chastening and enlightening experiences, which help students to appreciate something of the difficulty of good scientific work, as well as the magnitude of past achievements. Again, to follow out Aristotle's account of the embryonic development of the chick with a collection of actual chick embryos before one, or to re-enact Galileo's experiment with the inclined plane at the same time as studying his printed argument: these can make science a living and absorbing subject for people who might otherwise think of it as a collection of incomprehensible jargon and formulae. Given the goodwill of one's scientific colleagues and a room to stage demonstrations in, there is no limit to what can be done; and besides this, quite a collection of films now exists, on such varied subjects as the discovery of oxygen, the principles of inheritance and the kinetic theory of gases, which can make the lecturer's task of presenting scientific ideas to non-scientific students a little less difficult.

I had the impression that the 'A' course at Melbourne had by now reached a more or less settled shape. To begin with, for reasons both of history and of logic, it had seemed natural to spend the first term of the course on dynamics and astronomy. In the light of experience, this practice has been abandoned: Arts students are often far too aware of their lack of mathematical equipment, and once they have taken fright their interest and confidence are not easily recaptured. So, after some introductory lectures on science and myth, and on the ideas of the Greeks, it has been found better to tackle the biological topics first. Astronomy and dynamics, when their turn comes, cannot help seeming more technical and difficult to grasp

than biology, but they prove nothing like the same obstacle to students who have already been taken through a term or more of the history of biological ideas without losing the thread.

(B) The course for science students at Melbourne (History and Methods of Science 'B') is at present less time-consuming – two lectures and one discussion per week. Though much of the ground explored is inevitably the same as that covered in the 'A' course, the approach is different: a good deal of elementary information has to be given to Arts students of a sort one can take for granted with scientists, and it is not necessary with them to dwell laboriously on such things as the distinction between speed and velocity – especially as the course is not taken until the second or third year. So, whereas the 'A' course couples history with elementary science, it becomes possible to introduce in the 'B' course much more in the way of logic and philosophy. 'What sort of thing is a theory? Can teleological explanations be scientifically respectable? What is the role of mathematics in science? Can a single experiment ever decide the fate of a theory? Are there essential differences between the biological and physical sciences? How far are scientific ways of picturing the world compatible or incompatible with (say) artistic or religious ones?' These are all questions which the budding scientist will want to discuss in any case, and they can find a natural place in a course on the history and methods of science, alongside more historical studies.

If anything, the daunting thing about a course of this kind is the very number of possible topics. A critical discussion of the historical development of dynamics, paying careful attention to the logical character and relevance of the laws, theories and observations remarked on in passing, could occupy the whole available time: to provide the same also for geometry, evolution theory, genetics, atomic theory and all other deserving and absorbing subjects is out of the question. One is obliged to compress, to select, and to get the students themselves to cover a good deal of the ground in papers for discussion classes. This is certainly a subject in which a lecturer need never grow stale, for one could choose a different selection of topics to concentrate on for quite a number of years without being in danger of boring oneself by repetition.

Special Problems of a History and Methods of Science Department

The reasons why courses in the history and philosophy of science have so often languished or expired become clear when one realizes

how far Melbourne's work has been pioneering work, and considers the special problems that arise because of this. In most subjects university teachers when planning their courses and preparing their lectures can rely on an established tradition of teaching and a well-organized literature. A lecturer will normally teach only in a field which he has himself studied, at any rate in a general way, at the undergraduate and graduate level, the syllabus for his teaching will usually be well-defined, and in most cases plenty of set books and text-books will be available: his main problem will be to choose between them.

In the history and philosophy of science, a lecturer starts with none of these advantages. He cannot fall back for material on his own undergraduate instruction in the subject, since in the nature of things he cannot have read the subject as an undergraduate. This no doubt has its compensations – it is in many ways an excellent thing that the subject should be taught by people whose primary undergraduate training was in physiology, or philosophy, or history: they will bring to their work a freshness and variety of outlook which are of great value. Nevertheless, it remains a grave practical handicap, which enormously increases the amount of thought and work involved in planning and preparing courses of lectures.

These difficulties are aggravated by the state of the literature on the subject. Everyone who enters the field finds himself up against an undigested mass of primary and secondary sources: sorting and sifting this mass of material is a task of great difficulty. There are at last a few reliable text-books, and some useful anthologies of original papers are being published, e.g., by Professor Henry Guerlac of Cornell, but there is still a very long way to go before a satisfactory series of set books at different standards can be established. So long as the literature of the subject remains in its present unsatisfactory state, the lecturer's problems are usually heavy and difficult, and there is no substitute for personal attention to all the students' problems as they arise. In the absence of reliable text-books, tuition in small classes is indispensable, and a good deal of time has to be spent preparing roneo'd material for class use, and advising indvidual students on their reading. The result is that, on the tutorial as well as the lecturing side, the history and philosophy of science, if it is to be taught properly, involves more work than the average university subject.

Much the same is true on the practical side of the subject. Demon-

strations and group experiments, I have argued, have an important part to play in history and philosophy of science courses, but the nature of these demonstrations and experiments has still largely to be worked out. Selecting suitable subjects for demonstrations and collecting and assembling apparatus accordingly involve more work than the corresponding tasks in an established science course.

All these problems help to explain the fate of so many ventures in the field. The lecturer who takes on a course in History and Philosophy of Science with a divided mind is hard put to deal with it in such a manner as to satisfy the most important of his customers, namely, *himself*. Though he starts off keenly enough, his primary responsibilities and loyalties – to history, philosophy, chemistry or whatever – tend to be the more exacting in the long run, and he finds it hardly possible to do justice to both subjects. With this on top of the other discouragements, it is excusable if he is tempted to abandon his attempt.

The Need for Research

One more general difficulty remains to be mentioned. I have discussed the two most important of the Melbourne department's formal courses; but a department of this kind has a lot to do besides give formal lectures. Both the history of science and the philosophy of science are subjects in which many legends come disguised as established facts, and anyone who begins to study them at all critically soon learns to distrust even the most confident and often-repeated statements for which detailed documentation is not produced. So he soon finds himself drawn into research, and this – the necessity for active original research – is perhaps the strongest argument of all for making the subjects a lecturer's full-time, not spare-time, study.

Many of these legends survive uncriticized as a result of the fact that the subjects have commonly been used as vehicles for propaganda on behalf of modern science rather than as fields of scholarship. Whether the subject under discussion be the sixteenth-century revolution in dynamics (Galileo's criticism of the Aristotelian theory of motion), Harvey's work in the next century on the circulation of the blood, or the new system of chemistry produced by Lavoisier at the end of the eighteenth century: in every science and period, the picture of great, modern-minded men overthrowing false and antiquated errors stands between us and a proper understanding. This

picture of the progress of science has a certain appeal, not least to our historical self esteem. It would be pleasing if we could believe that the abandoned ideas of our predecessors were simply false, if not ridiculous, and that our own ideas stand as firmly as can be asked; so, looking back on the history of earlier science, there is a temptation to look for those things which can be presented as anticipations of our own ideas and to dismiss the rest as superstition; even the most respected historians of science sometimes find this temptation too strong for them, as those will know who have read Professor Sarton on the subject of Aristotle and Plato.

Yet this picture of the development of science is almost totally false. 'The more we treat the theories of our predecessors as myths the more inclined we are to regard our own theories as dogmas': the task is to get both sets of theories into proper focus. But it will take a long time to adjust completely the binoculars through which we survey the history of science in the way required, and to correct the perspective in which the chief steps in the development of the science are presented. And so long as this task is incomplete – as perhaps it always will be – the need for active research on the history and philosophy of science will remain urgent. To return to the examples I referred to: Aristotle's relation between the time and force required to move a body between two points and the resistance of the medium through which motion takes place still has its place in our own dynamics, though it is credited to Stokes; as for Harvey's admirable work, it now seems likely that Galen himself recognized the major circulation of the blood and the function of the capillaries, and Harvey himself certainly expressed great respect for the man whose work he is popularly thought to have discredited; while Lavoisier, magnificent though his reordering of chemical theory was, never came to accept all the key ideas of the modern view – it was not even clear to him that oxygen gas should be thought of as a pure elementary substance. Few of the clear-cut steps forward we are told about in partisan histories of science will stand up to scrutiny.

So, while history and philosophy of science courses are undoubtedly valuable as instruments of education, there is another function quite as urgent which they can perform – that of acting as excuses for long overdue research. There have in the past been perceptive philosophers of science and brilliant historians. But they have largely been amateurs, stealing time from other occupations and cultivating their chosen flowers of learning as often as not in isolation. The conse-

quences have been all that one might expect of a subject without continuity or traditions. The first is waste of effort: the discoveries of one generation have been lost and painfully found again by a later one – not so much for lack of published writings, but because of the difficulty of discovering what has been written or published on any subject. (This particular trouble is being met in our own time by the great series of 'Isis' bibliographies, which will by themselves ensure Professor Sarton's fame as a historian of science.)

Another sign of amateurishness is the high incidence of crankiness: no doubt in the natural sciences also people take up one subject or another for all sorts of ulterior and irrelevant reasons, but the tradition of their subject normally proves stronger than their particular fancies. They begin by hoping to find in biochemistry, say, proof of the existence or non-existence of the soul; but they soon settle down to producing sound pieces of biochemical research, returning only to their King Charles' heads when they feel themselves temporarily off-duty, over a beer or over the air or preparing an inaugural lecture or public address. In the history and philosophy of science, by contrast, crankiness is uncontrolled by tradition. The desire to prove – I take only one example – that the medieval church was 'obscurantist', or alternatively that it was the true inventor of the modern scientific method, can play in consequence an excessive part even in serious and otherwise authoritative works on the subject. And if one wants an extreme instance to show how far we yet are from a crank-free approach there is always Professor Sarton's own mis-handling of the unfortunate Plato, with its curious suggestion that a man credited with such a love-life *could* not have contributed anything to the perennial scientific tradition.

The fact is, that professionals are in any sphere the channels of tradition, and that there will be no central, authoritative tradition in the history and philosophy of science until the subject has enough of its own professionals. By all means let the amateurs carry on with their works of love and supererogation. It is better than nothing by far for a university that occasional lectures on the history and philosophy of science should be given there by people who feel strongly enough about the subject to study it in their spare time. But once it has been seen how much about the science of our ancestors remains unknown, how much even of what is known remains misunderstood, and how this ignorance and misunderstanding come between us and a proper appreciation of our own science and culture, one will be

excused for thinking that it is time for other universities to follow the example of the few honourable pioneers, and to treat the History and Philosophy of Science as more than agreeable and intriguing frills.

My plea is not original. It is more than a century since Saturday, 24th April 1854, when one finds that great Master of Trinity, William Whewell, D.D., F.R.S., delivering at the Royal Institution, in the presence of H.R.H. Prince Albert, a lecture 'On the Influence of the History of Science upon Intellectual Education'. Let me finish with some words of his:

> In the History of Science, we see the infinite variety of nature; of mental, no less than bodily nature; of the intellectual as well as of the sensible world. The modes of generalization of particulars, – of ascent from the most actual things to the most abstract ideas, – how different are they in botany, in chemistry, in geology, in physiology! yet all most true and real; all most certain and solid; all of them genuine and indisputable lines of union and connexion, by which the mind of man and the facts of the universe are bound together; by which the universe becomes a sphere with intellect for its centre; by which intellect becomes in no small degree able to bend to its purposes the powers of the universe.
>
> The history of science, showing us how this takes place in various forms, – ever and ever new, when they seem to have been exhausted, – *may* do, and carefully studied, *must* do, much to promote that due apprehension and appreciation of inductive discovery: and inductive discovery, now that the process has been going on with immense vigour in the nations of Europe for the last three hundred years, ought, we venture to say, to form a distinct and prominent part of the intellectual education of the youth of those nations. And having said this, I have given you the ultimate result of the reflections which have occurred to me on this subject of intellectual education, on which I have ventured to address you.

HIGHER EDUCATION IN THE COLONIES

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IT IS A peculiar and surprising characteristic of the English people that they often manifest their most civilized behaviour when they are in great difficulties and, indeed, in danger of destruction. In better times unfriendly critics have remarked that the English appear hardly civilized at all and have hinted that their good works in periods of stress are evidence of nothing more than a simple desire to stand well in the accounts of eternity when it is obviously expedient to do so. Whether or not this cynical view of our good behaviour is justified I shall not discuss at length, but will be content with the remark that even if the belief that salvation depends on works plays some part in determining our conduct, it is not entirely responsible for it because we rarely undo subsequently the work we undertake in times of danger.

The abolition of the Slave Trade and later in 1833 the abolition of slavery in all British possessions heralded the dawn of a new conception of the colonies: there were some then, as there are many today, for whom the colonial territories are a trust rather than fields to be exploited for profit. That conception, strengthened by the devoted work of missionaries, flourished in the first half of the nineteenth century. Its penetration into English society is shown by Dickens, who was always topical, in his sketch of the fatuous Mrs. Jellyby in *Bleak House*, who was so devoted to the wellbeing of the natives of Borrioboola-Gha on the river Niger that she neglected her duties to her family in the interests of Borrioboolan business. Later, in the long Victorian peace and prosperity, the new conception faded but the impact of events in India and the manifest indifference or frank dislike shown by many colonial peoples for British rule during the last war revived it and once again the English, in a time of danger, turned their thoughts to higher things.

Future historians reviewing our activities since 1939 will, it is my faith, find much they can unreservedly approve, but I doubt if they will find anything to rank higher than our changed attitude to the colonial territories. The progress of the colonial universities and colleges seems to me to offer significant evidence of the more enlightened attitude of the English to the natives' problems.

At the end of the war there were two universities in the Colonies and both were in ruins. Hong-Kong had been sacked by the Japanese; the library, however, was saved by a devoted staff who buried and concealed the books. Malta was wrecked by the bombing of the island and university work was at a standstill. It is true that the University of Ceylon and the Hebrew University of Jerusalem survived, but as Ceylon became a dominion in 1948 and the Palestinian mandate ended about the same time I do not propose to consider their development, though we may be justly proud of the part we played in their establishment.

Ten years ago, then, there were two shattered and ghostlike universities in the colonies. Today there are three active universities – the revived Malta and Hong-Kong institutions and the new foundation in Malaya which was based on the union of Raffles College and the King Edward VII School of Medicine – and no less than six university colleges, in the West Indies, the Gold Coast, Nigeria, East Africa, Sudan and (the latest) at Salisbury, to meet the needs of the federation of the Rhodesias and Nyasaland.

In 1946 there were 726 students in the colonial university institutions. In 1954 there were no less than 4,592. But that is not the whole story, for a large number of native students leave their countries to get university teaching overseas. In the universities of the United Kingdom and Ireland in 1946 there were 1,031 such students: by 1954 the number had risen to 2,915. In other words the total number of colonial students at university institutions of British origin rose from 1,757 in 1946 to 7,507 in 1954. Comparable figures for the universities of Europe and the Dominions are not available. It is known, however, that in 1953 there were 871 colonial university students in Canada and Australia. In the United States of America the figure rose from 534 in 1946 to 1,620 in 1953. There has been an even greater increase in the number of colonial students in the United Kingdom in institutions other than universities – from 983 in 1946 to 6,986 in 1954.

That is a brief statistical summary of the progress achieved in the past ten years. How has it been accomplished, and what have been the problems entailed by such rapid expansion?

The story begins in 1942 when the Cabinet discussed the steps to be taken to ensure the development of British colonial policy. In the past we had often proclaimed our intention to equip native populations for the responsibility of self-government, but we had

not, in truth, done very much to help them to achieve that purpose. It may, therefore, be counted a virtue that despite the anxieties of the war, the government established the Asquith Commission in 1943 with the following terms of reference:

> To consider the principles which should guide the promotion of higher education, learning and research and the development of universities in the colonies; and to explore means whereby universities and other appropriate bodies in the United Kingdom may be able to co-operate with institutions of higher education in the colonies in order to give effect to these principles.

The Commission met in London and Sir Raymond Priestley, one of its members, has dryly recorded his opinion that one of the ways in which inquiry by commission is made tolerable is to instal it in a capital city under air attack, for he found that retirement to a basement or a meeting under rather than round a table did much to reconcile opposing views and to expedite business. For the Asquith Commission there were available two comprehensive reports, one on the situation in East Africa (the De la Warr inquiry) and the other on Malaya (the McLean report). Committees of investigation were therefore sent to West Africa under Mr. Walter Elliott and to the Carribean under Principal Irvine of St. Andrews while work continued in London.

Certain fundamental problems had to be determined. Was it wise to establish universities in colonies where secondary school education had hardly developed or should the élite of the native students be encouraged to seek university training in the United Kingdom, the dominions or elsewhere? An analysis of the accommodation available in the universities of the United Kingdom showed that it would be impossible to find places for many colonial students and there was no escape from the necessity of building new institutions overseas. But what sort of new institutions? Should they aim forthwith at full university status or be content with technical colleges and institutions for professional and vocational training?

The bias in favour of technical training before everything else appears in the impatient remark of a senior West African administrator when the question was put to him by a member of the Elliott Commission: 'My people don't need universities: what they need is food and shoes.'

It says much for the courage of the Asquith Commission that they rejected the easier and more popular solution of their problem and

in their report in 1945 stated unequivocally: 'In the interest of higher education in the colonies it is essential that universities should be established at as early a date as possible in those areas which are not now served by an existing university. The immediate objective is to produce men and women who have the standards of public service and the capacity for leadership which the progress of self government demands and to assist in satisfying the need for persons with professional qualifications required for the economic and social development of the colonies.'

In retrospect I think there is little doubt that this fundamental decision was wise. The native leaders of colonial thought resent any suggestion of inferiority and would hardly have supported technical institutes in the way that they have shouldered the financial and other responsibilities of their own universities.

The decision in favour of high university standards with a broad range of study was important, but of hardly less significance was the insistence that the new institutions should be autonomous and so far as possible independent of political control. In most of the colonial universities administration has developed very like that of modern English universities. The Senate is responsible for academic policy, but its decisions are subject to approval by a council which includes not only members of the Senate but also representatives of the governments that provide financial support and independent members. The constitution of the University College of the Gold Coast is particularly interesting. In his report of 1953 the Principal records that 'The By-laws are based on English university tradition. Much of their detail is owed to the 1926 Statutes of the University of Cambridge, but in some fundamental respects they are more akin to the civic university constitutions (for example, in the dependent status of the Halls and in the centralization of teaching). They seek, however, to correct some of the failings of the latter type of constitution, especially in the wider membership of the Senate, in its increased financial powers, and in the closer relationship between the financial and the educational authorities of the College.'

The establishment of autonomy in the colonial universities raised another problem. With academic policy committed to Senates which in the early years might well be somewhat immature and lacking in tradition and experience of matters of university government, how could the maintenance of high standards be ensured? The solution was found in a manner characteristically English and empirical.

The University of London, at the suggestion of the Asquith Commission, entered into special relationship with the new institutions. Members of London University staff determine the shape of curricula in consultation with the senates of the colonial institutions and take part in the examinations of students, so that the degrees awarded are directly comparable and indeed are known as degrees of the University of London (except, of course, in the three full colonial universities). The system so far has worked well, but the rapid expansion of the colonial colleges and the great size of London University may make some modification necessary in the near future. I will return to this question later.

Two other decisions of the Asquith Commission are worth notice. Local conditions and the vast areas from which students are recruited to colonial universities make it imperative that most of them should be fully residential (the exceptions are Malta and Malaya). This is, of course, desirable in itself but increases costs and delays rapid expansion. And, finally, the Commission insisted that staffs should not be engaged wholly in teaching but should be expected to undertake research. In certain subjects, anthropology, botany, zoology, tropical and veterinary medicine, for instance, the colonial institutions provide opportunities for research unrivalled in the world. In linguistics, too, and in agriculture and the social sciences there are great unexplored fields. But the cost of apparatus and the shortage of technicians limit research in physics and chemistry. The fact that research is expected of the staffs undoubtedly improves its quality and widens the field of recruitment.

The Asquith Commission recommended the establishment of an Inter-University Council to advise the Colonial Office and to assist the colonial institutions in their early years, and this was done in 1946. Every university in the United Kingdom appoints one member and there are in addition a number of co-opted members chosen for their special knowledge. The Council meets in London and the principals and vice-chancellors of the colonial universities are often present. Its proceedings are exceptionally interesting and the problems diverse and sometimes curious. For instance, the first question put to me was whether I could teach medicine in Chinese, to which the only possible reply was that I personally could not do it and that in any case it would be difficult owing to the lack of textbooks and literature. The relevance of the question was to a local demand in Hong-Kong for Chinese courses in the university to meet the

needs of the large number of migrants from the mainland who had had no opportunity to learn English.

The Inter-University Council is purely advisory and has no executive power, but in general its judgement has been readily accepted both by the Colonial Office and by the local governments and university authorities, though prolonged negotiation has naturally preceded agreement on several occasions. The advice of the Council has proved particularly valuable in shaping the constitutions of the colonial institutions and in keeping them out of the battlefield of local politics and racial prejudice.

One of the fundamental problems is Finance. The Colonial Development and Welfare Acts enable the British Government to allocate money to capital projects in the colonies.

Since 1945 under this authority a sum of £11,750,000 has been allotted to universities, and another two million pounds was made available for teaching hospital development and other special purposes. This modest sum has been supplemented by generous grants from local governments and private sources. For instance, the Government of Hong-Kong gave £1,000,000 as a contribution to the Endowment Fund of its University, the Gold Coast £2,000,000, Nigeria £2,250,000. The Cocoa Marketing Board gave a million for the endowment of a department of agriculture. I have made a rough estimate of the total collected locally for capital purposes since 1946 and find that it is approximately £20,000,000, and that takes no account of valuable gifts of land. In addition it is important to emphasize that all recurrent day-by-day expenditure is the responsibility of the colonies and no part of it is paid from the British Treasury. It is generally agreed that these immense sums have been collected more easily because the donors know that the advice of British universities is available for the guidance of the colonial institutions in spending them.

So far I have been summarizing what seems to me a civilized achievement by the British people in difficult years, and it is curious that it has had so little public recognition. But it must not be assumed that all has been plain sailing and that there have been no difficulties or anxieties. I propose to conclude, therefore, with a brief statement of the continuing problems and a reference to published criticism.

When the Asquith Commission decided that institutions of university status should be established in the colonies, they did so in the certain knowledge that progress would be slow in view of the

dearth of good primary and secondary schools. In many places it is necessary to do sixth-form work in the universities and for the ordinary degree course to extend over four or five years instead of the usual three. The suggestion has been made that it would have been better to establish more schools and delay the university institutions for some years. But this ignores two crucial factors. Where were the teachers to be trained for colonial schools? There was certainly no surplus of teachers elsewhere in the world to supply the need. An educational system can not develop in separate fragments. Universities look to schools for their students and schools look to universities for their teachers; both must develop together. The second factor was the intense desire in native colonial people for university education. To leave that demand unsatisfied might bring political disaster and I think there is little doubt that the Asquith Commission was right in its decision to establish university institutions without delay. But what sort of universities? The great tradition of the old universities in this country has properly inspired many of the ideals and aspirations of the new and it is not surprising that it should have influenced development in the colonies.

The problem today, therefore, is whether it is wise to develop universities like Oxford and Cambridge for primitive and impoverished people and to try to do it quickly. Might it not be better to narrow the range of university work in the colonies and restrict it in the early stages to subjects with direct relevance to the obvious material needs of the population? Should there be, for instance, deliberate encouragement of medicine, agriculture, veterinary science and all types of engineering in the immediate future, with some sacrifice of the humanities? The argument for colonial uniuniversities of this type has been pressed by Mr. Thomas Balogh, a Fellow of Balliol. In *The Times Educational Supplement* (27th May 1955) and again in the UNIVERSITIES QUARTERLY (Vol. 9, No. 3) under the aggressive title 'Oxbridge Rampant' he advises the colonial authorities not to adopt the belief of the older English universities that the special and mysterious art of administration is best obtained by a judicious mixture of breeding, character and purposefully useless, dilettante erudition. This curious system, says Mr. Balogh, was popular and successful in England until 1914 because it ruled out the plebs. Charity and candour warrant the comment that it may have had other virtues but Mr. Balogh, who obviously likes a trenchant phrase, goes on to assert that 'the colonial universities are cursed

by an ill-balanced desire, strongly fostered by undaunted Oxbridge educationists monopolizing authority, to imitate the least attractive features of the two older universities without that chaotic liberty which makes them tolerable.' All that they have done, he claims, 'is to split these underdeveloped societies into two hardly intercommunicating classes and to create an immense unemployable half-educated class of embittered and impoverished intelligentsia.'

It seems to me that this furious Fellow from Balliol bases both his opinions and his forceful and elegant argument on premises that are false. To begin with the figures show that the total number of graduates from the colonial universities is still pitiably small and that far from an immense unemployable class of impoverished intelligentsia, there is such desperate need for trained and qualified people in the colonies that every graduate from the universities obtains a job as soon as he wishes and that some students are tempted away from the universities by offers of lucrative employment before their courses are complete.

Mr. Balogh relies on figures he has collected from India where, he says, there are 300,000 students of arts and pure science but only 12,000 receive higher education in technology. To these he added, in a later paper, 35,000 engineers whom he had previously forgotten. News, I know, reaches Oxford slowly, but it is surprising than an economist and Fellow of Balliol should not have noticed that India has been a self-governing republic for some time and that the Inter-University Council (which was established in 1946) had no influence in the development of its universities.

Mr. Balogh is inaccurate and grossly exaggerates the evils of a situation that does not yet exist but which might develop if the colonial universities shaped their courses without regard to the needs of the societies in which they work. There is a problem and I confess that it causes me some anxiety. The old university ideal of a general background of culture and humanistic study as a prelude to vocational or technical training seems to me a great and worthy one, but is it attainable quickly in primitive societies? My own University of Birmingham has evolved from a fusion of a technical institute for intelligent mechanics, a medical school and a theological college, and we know full well that time is still required for its full development. Our history is like that of most of the new universities in this country and their course might prove to be a better pattern than Oxbridge.

There is some doubt in my mind about the special relationship

with the University of London. The Irvine Committee, after investigating the situation in the Caribbean early in 1944, recommended that the new University College of the West Indies should be linked with McGill because the Canadian University was willing to staff the whole of the Medical School and to establish a department of research in tropical disease there. In retrospect this seems an imaginative and statesmanlike suggestion. The members of the committee found on their return, however, that the scheme for special relationship with the University of London had been approved and withdrew their tentative suggestion for fear of the delay a change would involve and because grave administrative difficulties might develop if the Medical School alone were linked with McGill.

Sir James Duff, a member of the Asquith Commission, also put forward a suggestion that was rejected. The following is an extract from his book (No. 10 in Commonwealth Affairs) entitled *Foundations of Freedom*:

> The suggestion was that each colonial college should enter into a 'one-to-one' relationship with a university in Great Britain, and should work for the degrees of that university until it reached university status and granted its own degrees. It still seems to the writer that such a plan could have combined the maintenance of high standards with greater flexibility in the arrangements needed for small units such as the colonial colleges in their early years. If the plan had worked well, it would have had other advantages. First, it would have meant that a great many British universities would have felt a direct responsibility for higher education in one particular part of the Commonwealth. Even a small amount of two-way traffic between the British university and its adopted college in the colonies would be valuable to both institutions. Secondly, the students of each colonial college who wished to come to the United Kingdom for post-graduate work of any kind would have felt that there was one university in Great Britain to which they could look for special consideration. Furthermore, it would be highly advantageous if overseas students in this country were more widely spread among its universities. At present London attracts far more overseas students than anywhere else; yet in spite of the unquestioned eminence of London University the difficulties and even dangers that beset the colonial student in Britain are probably greater in London than in any other city. The Asquith Commission thought that the advantages of uniformity outweighed these other considerations. Moreover, most British universities would have had to change their statutes in order to allow students of a colonial college to take their degrees. If one uni-

> versity were to undertake the task, the choice inevitably fell upon London. And let it be repeated that the highest praise is due to London for the enthusiasm and energy with which it has undertaken the task. A less formal relationship between pairs of British and colonial universities might become possible in future, when the colonial colleges have become universities and are granting their own degrees; and the writer obstinately maintains his hope for something of this sort to happen.

And so do I. That the colonial institutions are not entirely content with the present situation is shown by the informal approaches that are occasionally made to other British universities.

The cost of the colonial university institutions has attracted considerable adverse criticism and most of it is not well founded. High standards, the small number of students in the early years, long courses owing to the lack of sixth-form work in the schools, the need for halls of residence and the expense of travel all increase the expenditure of the colonial institutions, and if the total recurring annual cost (including some allowance for capital investment) be divided by the number of students it is found that the cost of graduation is about £1,500 annually for the four- or five-year course.

As much of the financial burden is supported by local governments (some of them in relatively poor areas) it is not surprising that criticism has come both from their treasury officials and from members of their legislatures, who have pointed out that it is cheaper to send a promising student to Oxford than to pay for him at the nearest colonial university college. It has been necessary to explain to them that fees are an almost negligible part of university revenue in Great Britain and Northern Ireland; that much of the cost of students at our universities is borne by the taxpayer either through the Treasury vote to the University Grants Committee or through grants made by local authorities to individual undergraduates, and that the British taxpayer should not be expected to contribute to the financial burden of Higher Education in the colonies.

Recruitment for the staff of the colonial universities is difficult because possible candidates are deterred by the uncertain political situation. Will the position of the European staffs suffer if the colonies achieve independence in the near future? Again a young man of promise feels that by emigrating to the colonies he will be isolated and remote from contemporary thought and progress in his subject, and if he has children he is naturally concerned for their

education and opportunities in life. The Inter-University Council has done much to meet these difficulties by fostering the establishment of libraries with an organization in London for the despatch of microfilms and photostats of papers to colonial universities, and by endeavouring to ensure proper consideration of applications from the colonies for appointments in English universities. The position is improving but is still not wholly satisfactory.

A recent analysis of the colonial university staffs gave the following result: excluding Malta there are in the colonial institutions 867 university teachers and higher administrative staff (with about 4,300 undergraduates). Of this total 532 (about 60%) come from the United Kingdom; 232 (about 26%) are native colonials; the Dominions supply 69 (about 8%) and the remainder come from European and American universities. The proportion of native staff is highest in Hong-Kong. Clearly the influence of Britain and the Dominions is still dominant, as they supply nearly 7 out of every 10 of the university staffs.

With the passing of the years other problems have emerged. In few colonies has there been much provision for the education of women. When a native colonial has graudated at a university he may marry a girl who speaks no English and whose conception of a home is a hut of the most primitive kind. The social difficulties and the domestic strain that may ensue need no emphasis. In most of the colonies also there is a differential rate of pay in favour of the European in the Civil Service and other branches of employment. Not unnaturally this is resented by native graduates. The British professional organizations in medicine, veterinary science, architecture and all types of engineering have been somewhat reluctant to recognize the courses, degrees and diplomas of colonial institutions as adequate qualifications for admission to their registers, and the desire to obtain recognition of this kind induces ambitious colonial students to forsake their local institutions in favour of European and American universities. Of all the professions medicine has certainly been the most liberal in this respect.

Finally there is the outstanding problem of racial difference. The policy of the Inter-University Council has always been that the colonial institutions should be multi-racial and that admission to them should not depend on creed or colour. The ideal is admirable; the practice difficult. For instance, the Indians in East Africa sometimes refuse to eat the same food as the native population. Should

there be separate halls of residence for the different races? And if there are, will that not tend to perpetuate these racial difficulties?

The number of European undergraduates in the colonial universities is unfortunately still negligible. Time, patience and wisdom may eventually solve these enduring problems of humanity, but the colonial universities can justly claim that they have taken the first steps at the highest level and have made some progress.

In conclusion I say this: I have sketched briefly the story of higher education in the colonies as I have seen it during the past few years. It is, I hold, a story of work well done and of work well worth the doing for its own sake. But life has taught me that ideals may wither if material considerations are neglected. Once I had a conversation with a friend about these matters and he put two questions to me. Why do we bother ourselves about all this? What do we hope to get out of it? The answer to the first I have already given. If we are true to the liberal faith and tradition of our race we can do no other. The second question – What can we hope to get out of it? – is worth serious consideration because we should never quarrel with men when they consult their own interests: it is their nature so to do. I would reply that the matter of higher education in the colonies is of immense practical importance in furthering the interests of the British Commonwealth. The graduates of the colonial universities will be the leaders of their races. If they have reason to be grateful to the British influence in their universities, they will be predisposed to favour English tradition in their law and government and English products in their markets.

These political and commercial considerations have not escaped the attention of other nations. India is competing for the favour of the promising youth of East Africa and offers lavish scholarships at her universities. Germany is training, on very generous terms, large numbers of medical and technical students from West Africa.

This sudden liberality is not entirely disinterested. The last war destroyed the German markets in Africa for chemical, electrical and other engineering products. How better re-establish them than to send doctors and engineers back to their native places schooled in German methods and technique? The ideal and the earthy go hand in hand. Which should lead is a matter for individual judgment.

SCIENTISTS FOR THE UNIVERSITIES

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MUCH has been said, and indeed something is at last being done, about the need for more scientists and technologists. Assuming that the necessary talent is latent in the country, the next most crucial factor is the ability of the schools, technical colleges and universities to teach the rising numbers of students. Despite its vital importance, however, the school teaching of science has been allowed to become a frustrated and depleted profession; and although at last the school situation is a matter of national concern, it is not yet widely realized that we should already be trying to save science teaching in the universities from the same decline.

The signs that something is wrong are evident in the difficulties in appointing staff. One university physics department was six lecturers short a few months ago; another had ten vacancies, and my own has six; these figures represent between twenty and thirty per cent of established strength. Another university has decided not to fill a senior lectureship which it had advertised, while yet another had more vacancies than applicants in 1955. At the professorial level, the situation is no better: the long delays in filling chairs in physics in the last few years show that all is not well. An example has recently occurred where a vacant chair was offered to, and turned down by, a physicist in government service, not because of salary but because the chair was less attractive from a research point of view than his government post as head of a large research group. All the foregoing examples are taken from physics, which is probably the worst-hit subject, but other sciences are suffering as well – or will suffer in the future whenever, paradoxically, they produce results of value to Defence or Industry. The effect may not yet be sharply felt in those universities which form the main centres of research, for it is clearly a trouble which sets in at the periphery first. Gradually it will advance on the main centres.

To see why scientists are becoming less willing to join university staffs, it is only necessary to compare the position today with that of thirty years ago. Neither the Government nor industry was as appreciative of the value of scientific research as it is now; in fact,

Russia was probably the only country where the Government, following Lenin's early association with the electrical engineers, made a truly active effort to encourage science and technology. Be that as it may, the fact is that in this country the universities were almost the only places where pure research was being done. Even though a professor's or lecturer's research was hampered by his teaching duties, so was the research of most of his colleagues or rivals; while, therefore, teaching retarded the absolute rate of research, it had little effect on the relative rates of, say, two individuals in the same field. Some measure of teaching duty was, therefore, almost implicitly accepted as the price of the privilege to research.

Today, the situation is different. The 1939–45 war made both the Government and industry realize that research was vital to our military and economic survival. Pre-war Government research establishments were expanded, and new ones created. Those far-sighted firms which set up research departments before the war prospered enough to expand these departments after the war. Many other firms have created research departments since 1945. Great new activities such as the Atomic Energy Authority are absorbing science graduates as fast as they can be produced. These facts are, of course, well known. Along with our pre-war inclination in the universities to value science well below the humanities, they explain the present shortage of scientists.

But the present university science position is not explained simply by the general shortage. When the Government or industry pays men to research, it wants results before its rivals can get them. The research worker in Government or industry, at least in the better establishments, is therefore encouraged to devote all his effort to research. Thus, even if he had no help, he could proceed at about twice the rate of the university worker, who usually spends at least half his energy on teaching duties, even when vacations are counted in. The difference, however, is still greater, since to ensure that the Government research worker proceeds at full speed, he is provided with assistance on a scale no university can contemplate. The average Scientific Officer, for example, in a good research establishment may be supported by up to two Experimental Officers and one Assistant (Scientific), besides suitable workshop resources. The average university lecturer is very lucky if he has one-half of a mechanic's or technician's time to devote to his researches, and he hardly ever has any helper of the Experimental Officer class.

Now it may be thought that, even so, the universities would not or ought not to be in competition with, say, Government establishments, for the former should undertake pure research, while the latter are obviously more interested in applied research. The fact is, however, that the more progressive Government establishments realize that applied research cannot flourish alone, and that the best way of enjoying the stimulating effect of pure research is to have it going on in the same establishment. It has thus come to be true that in some fields the best facilities in the country for pure research lie in Government establishments or Government-sponsored research institutes. It follows, as many professional scientists are now realizing, that the best way of making headway in some of the most exciting fields of pure research no longer lies in the universities. In fact, a university department is likely to fall further and further behind.

As with school teaching, the position is self aggravating. The more the vacancies on university staffs, the greater the teaching load on the remaining lecturers, and the more these must fall behind in research. Then, as it becomes known that the universities are no longer the places where the prizes of research are to be found, we shall cease to recruit the more able men. In turn the teaching will suffer, and the universities will be in as poor a position as the schools.

Having helped the country through difficult and dangerous times, the university scientist is in an unfortunate position. In research he lacks the facilities and opportunities of his colleague in a research institute. In pay, he does not do so well as his colleagues in industry, or in Government service if the new rates recommended by the Royal Commission on the Civil Service are approved. He works alongside medical colleagues who are paid considerably more than he is. His hours, if he is conscientious and tries to research, are much longer than those of many of his arts colleagues, and yet we have the strange position that while medical salaries in universities are set by the market value of practising doctors, the scientist's salary is set by equating it not to his market value but to the salary of his colleague in arts. And while the science schoolteacher is, rightly or not, exempt from National Service, the university science lecturer is not. It is in fact the break caused by National Service that shows many potential university recruits the facilities and salaries that are to be found elsewhere. Finally, the university scientist is in constant danger of losing what technical assistance he has, since technicians are always being attracted away by higher salaries in Government or industrial

establishments or in the National Health services. Curiously, the Government does not encourage the universities to pay their technicians at similar rates to those which it pays to technicians in its direct service.

Despite all this, there will always be some of us who will appreciate both the advantages of a university life and the need to produce good graduates, and who will make sacrifices to hold the position to the end. But the altruism even of university staffs cannot be strained too far, and it is not right that much strain should exist.

Neither the Government nor industry is to be blamed for trying to do what it sees as its own job more efficiently; indeed, industry is to be praised for its recent gesture in the direction of science teaching in the schools. But the time is overdue for an examination of the effect of the growth of the research establishments on the universities. A full examination would be beyond the powers of one man in a single article, but it might be worth looking at a few of the possibilities.

One factor may be taken as axiomatic. Teaching suffers if it has no direct contact with research. Therefore any solution must be rejected which demands that the universities should give up research in any of the subjects that they teach. Instead, the universities must expand their facilities for research, by reducing the teaching load on the individual worker and providing him with more help. This may make the science departments large in comparison with their sister departments in arts, but this is a comparison which is not relevant. The relevant one is with the research institutes with which the university science departments are in competition. Despite the difference in size of science and arts departments, it is probably a better solution to keep them together than either to take the teaching of science away from the universities and combine it with the research institutes or to separate out the university science departments as 'science universities', which are the only two alternatives. The last one has the merit that the 'science universities' could then fight their own battles unhindered by the inevitable equation to arts in market value. They would also be free to develop their technical and administrative staffs without being held back by the concept of the structure of a university department based on experience in Arts, Divinity and Law. Indeed, if we were starting afresh to found universities today for the first time, it is by no means clear that we would put science and arts into the same institution, since their

problems of administration are so different. But there is so much to be said for the traditional linkage of science and arts in the universities that we should try to keep it intact.

It is not quite so impossible as it may appear to transfer much of the advanced teaching of science to some of the research institutes. Something of this is already happening on a minor scale, where research institutions provide either lectures for university students or advanced courses in technology for university staffs. But to be done on a large scale it would involve a widespread upheaval, and it would create many new problems.

The only other possibility is to keep the main responsibility for science teaching where it now lies, in the universities, and to fortify the science departments, particularly the physical sciences and engineering. This will require money and either a larger representation of the science departments in the government of the universities, or a greater degree of autonomy for the Science Faculties. This proposal is not a denigration of the other faculties, but a measure that may be forced on us to provide enough flexibility to meet the constantly changing situation in science. I value the contribution of the arts colleagues with whom I worked in the war far too highly to propose any measure that would seriously weaken their positions or their subjects.

Money can be found in two ways: direct grants to universities, or payments for contracts. The former is the preferable alternative, but the latter is practised with success on a large scale in America and to a limited extent here. It has several drawbacks, particularly since ability in getting contracts tends to replace scholarship as the chief attribute sought in new professors; but even this is better than the atrophy of the science departments that might otherwise happen. If operated well, the contract scheme would mean that a university department would contract to do specific pieces of research which would otherwise be done in a Government or industrial establishment. The staff could be paid at appropriate rates and provided with comparable facilities with those in the establishments. The profits from contracts could help to finance the university science departments at a level not at present possible. These steps would encourage men to stay in the universities, and thus keep research and teaching together. The objection that the purity of university research would thereby be adulterated can be countered by numerous examples from history to show that its practical applications have often led

science to the discovery of new facts, and hence to modifications to fundamental theory. Indeed, fundamental science has advanced more by virtue of its contacts with technology than by its contact with most of the traditional university subjects. The contract system therefore has something to recommend it, but it must be admitted that direct grants are better.

In some directions, the Government has already been generous to university science, particularly in the provision of large nuclear machines and items like the radio telescope. Experience is showing that the universities are not well equipped for administering these items, and there is much thought in favour of operating them at establishments separate from the universities. The considerations of this article indicate that in their own interests the universities should make great efforts to solve the problems of operating and administering the large machines, because otherwise it will not be long before these, too, are taken over by Government-sponsored central establishments, and one further incentive to university work weakened.

Apart from difficulties in recruiting lecturers, the universities are beginning to lose professors and readers to Government service. While some degree of interchange is beneficial, the universities are now unable to fill the gaps. Admittedly our too-small scientific effort has to be spread thinly, and the universities must take a fair share of the strain. But the symptoms show that too much is being asked of them, and that once again a goose is being slaughtered for a golden, or perhaps atomic, egg. With the prospective rise in the numbers of science students in the next ten years, the teaching load could become insupportable.

It is not too late to save the position. The universities are still attractive to men of science in that they alone offer contact with the humanities and with the plastic energies of youth; and they can sometimes offer rather greater personal freedom. Their position must indeed be saved. However pressing our immediate need may be for science graduates in defence and industry, we shall be aggravating – perhaps irreparably – the long-term need for scientists unless a proper proportion of our talent comes back into the universities to help the next generation into its rich scientific heritage.

T. H. HUXLEY'S IDEA OF A UNIVERSITY

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THE lifetime of T. H. Huxley, from 1825 to 1895, spans the great period of university reform in Britain. While he was yet an infant, London's University College was opened in Gower Street and King's College founded in opposition to that godless institution; before he had started school the *Edinburgh Review* launched its second series of attacks on the ancient universities of England; as the young medical student of twenty published his first paper Newman seceded from the Established Church and threw Oxford into turmoil; as the brilliant biologist of twenty-five was selected for Fellowship of the Royal Society the older universities were about to be investigated by their first Royal Commissions. In 1854, when Huxley was settling down as lecturer at the School of Mines in Jermyn Street, the Catholic University was receiving its first students in Dublin; by 1870, when he began to build the great science school at South Kensington, the University of London had consolidated its position as an immense imperial examining body and the older universities had begun to make substantial provision for the newer studies. When Huxley retired in 1885, religious tests had been largely abolished and women's colleges accepted at both Cambridge and Oxford, the sexes were admitted on equal terms to degrees at London, half a dozen provincial towns had their own University Colleges, and the work of university extension was started. Before he died, both Redbrick and Oxbridge had taken recognizably modern form, and in the last years of his life the movement to provide London with an effective teaching university took firm shape. Living through these decisive decades, and ever immersed in science and education, Huxley could scarcely fail to think about the problems of university education.

The context of his thinking was different from that of most nineteenth-century reformers. He had not trod the upper-class path from public school to ancient university, nor had he wealthy and well-placed relatives to ease his way. Leaving school at the age of ten and thereafter (apart from three years as a Free Scholar at Charing Cross Hospital) educating himself, he had no preconception of the university as a sort of *haut lycée* or finishing school for the sons of the

well-to-do. Apprenticed at fifteen to an East End physician, and always vividly aware of the educational handicap of poverty, he took it for granted that universities should be open to the children of the poor. Member of the Scottish Universities Commission and Rector of Aberdeen, intimately connected over forty years with the University of London, Governor of Owens College in Manchester, Huxley's thought was never straight-jacketed by any assumption that universities must be built of residential colleges. Friend of Jowitt and Mark Pattison and Goldwin Smith at Oxford, of Gilman at Johns Hopkins and Fiske at Harvard, of Brown-Sequard at Paris and Haeckel at Jena, he had every opportunity to consider the values of different traditions of university organization. And, increasingly as the years went by exerting great influence on Britain's cultural development, his idea of a university was of more than private significance.

Almost inevitably one examines Huxley's idea against the background of Newman's, and it is an interesting coincidence that Thomas Henry's father once taught the young John Henry at Dr. Nicholas's school at Ealing.[1] On the fundamental issue of the Church's ultimate regency over education there could be no compromise between the coiner of the word 'agnostic' and the man he described as 'the slipperiest sophist I have ever met with'. And, although Newman welcomed poor scholars at Dublin, his essentially aristocratic attitude was in marked contrast to that of Huxley. 'I ought to be thankful at the style of youths I have got', wrote Newman, '—the French Vicomte, the Irish Baronet, and our own Lord R. Kerr': it was in very different language that Huxley declared, 'I am a plebeian, and I stand by my order' and congratulated Aberdeen on not becoming 'a school of manners for the rich; of sports for the athletic; or a hot-bed of high-fed, hypercritical refinement'. For the one, poor students should be admitted as a charitable concession to an inferior class; for the other, the wealthy had simply filched the universities from their proper beneficiaries. There were many in those days who demanded that the cost of a university education be brought within the purses of the middle classes, but few like Huxley urged their opening to 'the sons of the masses of the people whose daily labour just suffices to meet their daily wants.'

Yet, Huxley had much in common with Newman. Children both of England in her hey-day, proud of their Englishness and even

[1] According to Father Henry Tristran (personal communication, 2. iii. 1953).

somewhat insular in it, they each had a passionate regard for truth and intellectual integrity and each was contemptuous of all merely human authority. They were similar, too, in the universality of their respect for learning, and the same puritan morality dominated the lives of Catholic convert and arch-agnostic. 'J.H.N. was simply a sceptic who backed out of it', wrote Leslie Stephen, and the *Spectator* once headed an article 'POPE HUXLEY'. Perhaps, after all, it is not so surprising that the two men's ideas of a university bore so many resemblances.

In his 1874 Rectorial Address at Aberdeen, Huxley spoke of his ideal of all universities:

> which, as I conceive, should be places in which thought is free from all fetters; and in which all sources of knowledge, and all aids to learning, should be accessible to all comers, without distinction of creed or country, riches or poverty. . . .
>
> In an ideal university, as I conceive it, a man should be able to obtain instruction in all forms of knowledge, and discipline in the use of all methods by which knowledge is obtained. In such a university, the force of living example should fire the students with a noble ambition to emulate the learning of learned men, and to follow in the footsteps of the explorers of new fields of knowledge. And the very air he breathes should be charged with that enthusiasm for truth, that fanaticism of veracity, which is a greater possession than much learning; a nobler gift than the power of increasing knowledge; by so much greater and nobler than these, as the moral nature of man is greater than the intellectual; for veracity is the heart of morality.

Not only the general line of thought, but in places the very words, remind us of Newman's description of a university as 'An assemblage of learned men, zealous for their own sciences' creating 'a pure and clear atmosphere of thought, which the student also breathes, though in his own case he only pursues a few sciences out of the multitude' and of his insistence that 'What I would urge upon everyone . . . is a great and firm belief in the sovereignty of Truth. Error may flourish for a time but Truth will prevail in the end'. One would suspect Huxley of plagiarism were it not that he does not seem to have possessed a copy of the Dublin discourses[1] and did not include a line from them among his thirty folios of notes from Newman's writings.

[1] The book is not listed in Sotheby's catalogue of H.'s library, nor does Mrs. Leonard Huxley remember seeing it among the books her husband inherited.

Both men took the traditional view of the university as a place of teaching universal knowledge, the coping stone of the general educational system, and Huxley expressed this opinion clearly at the official opening of Baltimore's new university in 1876:

> University education should not be something distinct from elementary education, but should be the natural outgrowth and development of the latter . . . the university need cover no ground foreign to that occupied by the elementary school. Indeed it cannot; for the elementary instruction which I have referred to embraces all the kinds of real knowledge and mental activity possible to man. The university can add no new departments of knowledge, can offer no new fields of mental activity; but what it can do is to intensify and specialise the instruction in each department. . . . The primary school and the university are the alpha and omega of education.

Just as Newman, himself a classical scholar, planned to establish a Faculty of Science at Dublin, so Huxley, although tireless in urging the universities to grant science its proper place, never failed to recognize the claims of literary studies. 'An exclusively scientific training', he declared at the opening of Sir Josiah Mason's College in Birmingham, 'will bring about a mental twist as surely as an exclusively literary training. The value of the cargo does not compensate for a ship's being out of trim; and I should be very sorry to think that the Scientific College would turn out none but lopsided men'.

This Mason College speech of 1880 has been the cause of a good deal of misunderstanding. When Huxley approved of the exclusion of 'mere literary instruction and education' he meant by that phrase 'the ordinary classical course of our schools and universites' which would lead merely to 'the introduction of the ordinary smattering of Latin and Greek', and his attack on the assumption that a liberal education was synonymous with instruction on classical antiquity was in no sense a criticism of literary studies. Connell's remark that in his 1882 Rede Lecture Matthew Arnold 'had no difficulty in showing that Huxley had not fully comprehended his concept of culture' does not take sufficient account of Huxley's specific exculpation of 'our chief apostle of culture' and his clear statement that he was criticizing only certain sentences capable of a narrow interpretation. The particular point at issue was Arnold's definition of culture as knowing 'the best that has been thought and said in the

world', and in fact he wrote to Huxley admitting that his wording had been unsatisfactory:

> I remember changing the word *said* to the word *uttered*, because I was dissatisfied with the formula for seeming not to include art, and a picture or a statue may be called an *utterance* though it cannot be called a *saying*: however I went back to *said* for the base reason that the formula runs so much easier off the tongue with the shorter word.

There was, of course, some real disparity; and Arnold could never have said, as Huxley did to the House of Commons Select Committee of 1868, 'Oxford and Cambridge put . . . science outside and underneath, which I conceive to be wrong; I am of opinion that physical science ought to be the primary instrument and subject matter of education, and literary culture secondary'. Yet, when an effort was made in 1886 to ensure that the new Chair of English Literature at Oxford should not be diverted to philology, the scientist gave stronger support than the poet.

Standing firm on the traditional ground that 'universities should be learning and teaching bodies devoted to art (literary and other), history, philosophy, and science, where anyone who wanted to learn all that is known about these matters should find people who could teach him and put him in the way of learning for himself', Huxley drew the logical conclusion that no arbitrary limits should be placed on the range of university studies:

> All universities recognize literature in the sense of the old rhetoric, which is art incarnate in words. Some, to their credit, recognize Art in its narrower sense, to a certain extent, and confer degrees for proficiency in some of its branches. If there are doctors of music, why should there be no masters of painting, of sculpture, of architecture? I should like to see professors of the fine arts in every university.

Once again, it is interesting to note that Newman thought so similarly that he had a Chair of Fine Arts in his university at Dublin.

Sharing Newman's view that 'A thorough knowledge of one science and a superficial acquaintance with many, are not the same thing', Huxley declared at Johns Hopkins University:

> It is obviously impossible that any student should pass through the whole of the series of courses of instruction offered by a university. If a degree is to be conferred as a mark of proficiency in knowledge, it must be given on the ground that the candidate is proficient in a certain fraction of those studies. . . . The important points to bear in mind, I

> think, are that there should not be too many subjects in the curriculum, and that the aim should be the attainment of thorough and sound knowledge of each.

And, in Huxley's own science school at South Kensington, the course was so arranged that students could at different stages concentrate their attentions fairly closely on specified areas of the whole field of study. But Huxley also believed with Newman that 'Any one study, of whatever kind, exclusively pursued, deadens in the mind the interest, nay the perception of any other', and it is fitting that his memorial in the Ealing Public Library bears the motto 'Try to learn something about everything, and everything about something.'

It was a quarter of a century before Huxley spoke at Baltimore that Newman had sympathized with 'those earnest but ill-used persons, who are forced to load their minds with a score of subjects against an examination', and in the intervening years examinations had proliferated in England: Kingsley's 'Isle of Tomtoddies' resounded all day to the praises of the great idol Examination, and in the University of London and the Department of Science and Art Huxley served the idol well. But not uncritically. 'Examination – thorough, searching examination – is an indispensable accompaniment of teaching . . .', he told the assembled University of Aberdeen, 'but my admiration for the existing system of examination and its products, does not wax warmer as I see more of it. Examination, like fire, is a good servant, but a bad master; and there seems to me to be some danger of its becoming our master . . . students . . . work to pass, not to know; and outraged Science takes her revenge. They do pass, and they don't know.' Not surprisingly, his feeling was 'distinctly against any absolute and defined preliminary examination, the passing of which shall be an essential condition of admission to the university', but it was to be many years before the universities' somewhat narrow and rigid matriculation requirements were to be relaxed in the way that he would have wished.

Newman's prescription for avoiding the ill effects of specialization and examination was residence and tutorial superintendence. To the former, Huxley's writings scarcely refer; but he sent his own son to Balliol and, in a man who ever lay about him with vigour at everything of which he disapproved, perhaps the absence of reference to residence implies approval combined with recognition of its impracticability in the universities with which he was most concerned. About the merits of close tutorial supervision Huxley had no doubts,

and in 1868 he told the Select Committee on Scientific Instruction that an important defect in the School of Mines was that 'the entire business of teaching is thrown upon the professors . . . that is to say, we have not the tutorial system as well as the professorial system, though both of these systems ought to be combined in any completely organized course of instruction'. And it was he who at South Kensington adapted the tutorial system to the requirements of scientific work in a manner now almost universal in the world's teaching laboratories.

The extent of agreement between Huxley and Newman is less surprising when one notes the faith of both in the potentialities of a liberal education. A liberally educated man, said Newman in Dublin, 'will not indeed at once be a lawyer, or a pleader, or an orator, or a statesman, or a physician, or a good landlord, or a man of business, or a soldier, or an engineer, or a chemist, or a geologist, or an antiquarian, but he will be placed in that state of intellect in which he can take up any one of the sciences or callings I have referred to, or any other for which he has a taste or special talent' (which leaves little warrant for Judges's remark that a liberal education is 'that which by Newman's definition is useless'). It was in very similar terms that Huxley in Baltimore asserted that with a liberal school education 'and with no more than is to be obtained by building strictly upon its lines, a man of ability may become a great writer or speaker, a statesman, a lawyer, a man of science, painter, sculptor, architect, or musician'. So far as professional education was concerned, Huxley held that 'the Faculties of Theology, Law, and Medicine, are technical schools, intended to equip men who have received general culture, with the special knowledge which is needed for the proper performance of the duties of clergymen, lawyers, and medical practitioners', and he would have students pass through the Faculty of Arts before entering on their professional studies. Indeed, according to his evidence to the Cowper Commission in 1892, it was 'a matter of indifference whether the technical schools for the professions . . . are called faculties or not' for 'The primary business of the universities is with pure knowledge and pure art – independent of all application to practice; with progress in culture, not with increase of wealth'.

But, while holding the traditional view of the essential function of a university, Huxley insisted that in one respect the modern university must be quite different from that of earlier days. 'The

mediaeval university', he wrote to Lankester, 'looked backwards: it professed to be a storehouse of old knowledge, and except in the way of dialectical cobweb-spinning, its professors had nothing to do with novelties. Of the historical and physical (natural) sciences, of criticism and laboratory practice, it knew nothing. Oral teaching was of supreme importance on account of the cost and rarity of manuscripts. The modern university looks forward, and is a factory of new knowledge: its professors have to be at the top of the wave of progress. Research and criticism must be the breath of their nostrils; laboratory work the main business of the scientific student; books his main helpers.' Truscot is scarcely fair to Newman in suggesting that his view would 'exclude research from the university altogether', and it is even doubtful if Judges was justified in speaking of his 'distaste for research', but undoubtedly here is a major difference of emphasis between Newman and Huxley. The former held that 'To discover and to teach are distinct functions, they are also distinct gifts, and are not commonly found united in the same person'; the latter agreed with the view 'that the best investigators are usually those who have the responsibilities of instruction, gaining thus the incitement of colleagues, the encouragement of pupils, and the observation of the public'. And, although Newman spoke of the university as 'the high protecting power of all knowledge and science, of fact and principle, of inquiry and discovery, of experiment and speculation', research and criticism were never the breath of his nostrils as they were of Huxley's.

Although Huxley held that the university 'is neither an institution for testing the work of schoolmasters, nor a machinery for ascertaining the fitness of young men to be curates, lawyers or doctors', he had no Simon Pure fear that the universities would be contaminated by undertaking new tasks; and, when towards the end of his life the great educational topic was the reorganization of the University of London, he set down on nine foolscap sheets his idea of how a modern metropolitan university might be constituted. Especially interesting is the proposal to organize the university in 'Colleges' (with a note that, to distinguish these 'Colleges' from the existing institutions such as University College and King's College, we 'want some other name') of the following types:

Institutions giving instruction for purposes of:

i. General Education (Arts).

ii. Professional education in

(*a*) Law
(*b*) Medicine
(*c*) The Industrial Professions
(*d*) The Scholastic Professions
(*e*) Painting, Sculpture and Architecture
(*f*) Music.

iii. Research in any of the Schools.

The three different types of 'College' (which were to share a common university chest) are clearly depicted as teaching institutions, either single or of a federal nature, and are not to be confused with the groupings of the university teachers in 'Schools' (*v. infra*). There is an obvious resemblance to a fairly common type of American university structure, with its Liberal Arts College and Professional Colleges and Graduate College, developed mainly in the present century, and this element in Huxley's plan is an interesting expresion of his awareness of the educational needs of an emerging industrial society. The Senate, which would have 'Supreme power in all affairs . . . with appeal to the Privy Council', was to include considerable professorial representation; but Huxley, ever anxious to avoid the establishment of an academic episcopate, notes the 'importance of having no seats on Senate attached *ex officio* to chairs in existing or future Collegiate Institutions'. Graduates were to have some share in university government, but that share was to be limited, as indicated by the note 'Convocation to have a right to be heard on any question by the Senate – and if necessary to appeal to Privy Council – but no veto'. Huxley's scheme contained no provision for a University Court, but he would stiffen the professorial body by some extra-academic representation on the Senate itself. Out of the Professoriate the Senate was to constitute 'Boards of Studies', which would, subject to the Senate's over-riding authority, consider questions of curriculum and examination. These 'Boards of Studies' would have exercised the functions of the present Boards of Studies and some of those of the present Boards of Faculties, while others of the functions of the latter would have been exercised by his 'Colleges'.

The students of the 'College of General Education', which was to be responsible also for Extension work, were to be examined by the university as such; while the 'Professional Colleges' were to have a semi-autonomous position, each arranging its own scheme of instruction and examination (under the joint supervision of representatives of the 'College' and of the appropriate 'Schools' of the

University) and presenting its students to the university on an *ad eundem* basis for the award of its professional 'degrees'. The 'Research College' in Huxley's sense would include not only institutions concerned solely with research, but also the non-professional research departments of other university institutions; and the degree of Doctor of Philosophy (which was in fact not to be instituted in England for nearly another thirty years) was 'to be conferred on the production of a good piece of original work – the sufficiency of which agreed to by the professors of the appropriate School of the University'.

As an example of how the Professional Colleges might be constituted, Huxley notes 'London Schools & Colleges of medicine organised into one body = *College of Medicine of the University*', and some further insight of the sort of structure he envisaged is given by a much earlier scheme for the professional preparation of science eachers. Some notes of 1869 include the following jottings:

> London Training College organization—Dean, etc. . . .
> Provincial Training Colleges
> Examining Body for the whole formed by selection from the professors of all the Colleges—
>
> ———
>
> Nominated for 5 to 7 years
>
> ———
>
> Examining body not to be called a University—
>
> ———
>
> National Institute
>
> ———
>
> Degrees granted by Minister on recommendation of Examiners.

At that time there was no network of provincial universities to provide nodes of regional organization, but by 1892 Huxley was prepared for the university instead of the Minister to grant 'degrees' on the recommendation of the 'Institute' or 'Professional College' – a somewhat remarkable anticipation of our modern Institutes of Education.

On the thorny question of the professional education of the clergy, he writes, 'There are obvious objections to the admission of a College of Theology among the Institutions for professional education recognized by the University if Theology is to be taken as the special theology of any particular Church or Sect – On the other hand, I conceive it is very much to be regretted that the study of Philosophy, History and Philology – which stand in the same relation to Theology

as the Institutes of Medicine[1] to Medicine – should be ignored in any University . . . assuredly there is room enough and to spare in these subjects not only for learning but for research –'. But, he concludes a little regretfully, 'I am afraid however that it is quite hopeless to expect that the various theological institutions in London would combine into a 'College' as the Medical Law and other Professional Institutions may be reasonably expected to do.' In the event, the Inns of Court were to remain outside the university, while some theological institutions were to enter in. Today, with the successful example of the University of London Institute of Education before us, it might perhaps be well to consider the possibility of developing Huxley's 1892 scheme in connection with other fields of professional preparation. There might, for example, be an 'Institute of Music' (with the Royal College, the Royal Academy and Trinity College as its principal constituents), an 'Institute of Theology' (including not only the four colleges and schools recognized in the existing Faculty of Theology, but also the clergy training colleges in the university's area), an 'Institute of Art', and so on – each awarding certificates and diplomas under the university's aegis as the Institute of Education does. But such speculations cannot be pursued further here.

Cutting across the organization of the teaching institutions into 'Colleges', the teachers themselves were, according to Huxley's plan, to be grouped and meet in 'Schools' as follows:

i. Philosophy (incl. Psychology, Logic, Metaphysics, Ethics, Jurisprudence)
ii. Mathematical and Physical Sciences
iii. History (Archaeology – General and Special History, Political Economy)
iv. Philology (General and Special)
v. Literature
vi. Painting, Sculpture and Architecture
vii. Music. –

Huxley's 'Schools' correspond approximately, but only approximately, to what are now called 'Faculties'. He had no 'Schools' of Medicine, Law, Engineering, Pedagogy, or Theology: the teachers in such professional subjects were to belong to his 'Schools' of Philosophy, Science, History, etc., according to their special studies. And

[1] 'Institutes of Medicine' is an old term for the foundation studies basic to the practice of medicine.

it may be that, for example, the regular meeting of philosophers (irrespective of whether they are concerned with professional training in theology or pedagogy or general education in arts or science) or of scientists (irrespective of whether they engage in professional trainin in medicine or engineering or general education in science) would be a very good thing. Unfortunately, such a dual organization of teaching institutions on the one hand and of teachers on the other cannot be regarded as a practicable possibility for the London University of today.

What then, may we say of Huxley's idea of a university? He built no monumental literary structure as Newman did in his Dublin discourses. In his deep concern for the proper recognition of the natural sciences he merely shared the views of many in his day. In his dislike of the aristocratic atmosphere of Oxford and Cambridge he had many contemporary allies and not a few predecessors. In his contempt for the petty pedantry of the grammarians he was in communion with all the leading spirits of the day. In his objection to religious tests he simply shared the views of all agnostics and nonconformists, and of the forward-looking anglicans also. In his insistence on a democratic form of university organization he was but the representative of an age becoming conscious of the meaning of democracy. Indeed, scarcely a view that he expressed on the nature of universities was an original one. It would, however, be very misleading to leave the matter at that: there may be novelty not merely in elements but in the mode of their composition, and it is in its composition that Huxley's idea of a university had significance for his time and has it still today.

If Huxley urged that natural science be given a proper place in the university, he did so in no partisan way but in full recognition of the value of other studies. He showed an awareness of the historical tradition of universities and an appreciation of their essential spirit, but he was also deeply conscious of the changes demanded by a complex modern society. Recognizing the dangers of a narrow scientific education, he perceived equally the perils of a narrow education in other specialities; but, seeing also the futility of fragmentary and superficial knowledge, he insisted on the virtues of specialization. In his objections to rigid matriculation requirements, he anticipated modern provisions for the admission of capable students whose earlier education has not followed the orthodox path; in his insistence that those who know a subject well are not necessarily

qualified to teach it in a university or to conduct examinations in it, he made a point that still needs making. He urged the development of the professorial system, but he valued the tutorial system and showed how to adapt it to the needs of practical studies. He agreed that its teachers should have a large share in the conduct of a university, but he saw also the desirability of some degree of general lay participation in control. He recognized the ancient supremacy of the Faculty of Arts as the coping stone of the education of the citizen, but he also wanted a more thorough development of university professional education. On every major issue Huxley seems to have sided with those who were forward-looking, but on each issue he avoided partisan extremes.

Huxley's idea of a university contained no novel element, but his sensitivity to the immediate needs and future trends of an emerging industrial society enabled him to foresee many developments and to suggest patterns of organization which might yet prevent the squeezing out of the essential life of a university by the enormous weight of modern social requirements.

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Higher Education in the Colonies by Professor A. P. Thomson is a revised version of an address given to the Graduates' Club, University of Birmingham.

History and Philosophy of Science by Professor S. Toulmin was originally given as a lecture under the auspices of the Manchester University Education and Extra Mural Departments.

Science and Human Values by Dr. J. Bronowski is appearing in UNIVERSITIES QUARTERLY in three parts, and is the revised version of the Carnegie Lectures which he gave at the Massachusetts Institute of Technology.

REVIEWS

Higher Learning in Britain. GEORGE F. KNELLER. *University of California Press: Cambridge University Press*, 45*s*.

Among British university people there is a greater interest today than ever before in American universities and in the criticisms by American visitors of our own. The day is past when we were content to think that educational institutions in the New World must still have much to learn, and that they were in addition handicapped by the extra problems set them by an over-abundant and indiscriminate optimism about higher education. There is now so much to-ing and fro-ing between American and English professors, especially in the sciences, that we now really know a good deal about one another, and are actively concerned to watch and seek to understand the comparative successes and failures of our two university systems.

Professor Kneller's book will therefore be approached by many British readers with lively interest; and it is well that it should be so. He has taken immense pains to study our university institutions in great detail; and on the whole the effect on him has been, I think, to strengthen his characteristically American appreciations and criticisms. What he has written gives the British student of our university institutions an excellent opportunity to sum up again for himself what the essence of the American philosophy is, and to try to understand the system of values behind it. It also gives him, I need hardly say, an excellent opportunity to make a new list of his own – not at every point the same as Professor Kneller's – of the shortcomings of our own principles and practices.

On the credit side Professor Kneller, like so many of his countrymen, is so generous as to make us feel uncomfortable and even doubtful whether he is entirely right. British universities, he says, are singularly independent of government interference; a method has been found of giving fiancial support by government without control; university appointments and 'personnel attitudes, rest on a much more secure basis than in other countries; administrative and executive staffs in general consist not of business-trained officials but of academic lecturers and ex-lecturers; neither the university nor the government shirks the responsibility, once a student is accepted as being of university calibre, of providing the material means for his education; the general attitude of administrators in British uni-

versities is that their prime duty is to serve teaching staffs, not to dictate to them.

This is a formidable list of virtues. The selection of items is evidence both of Professor Kneller's acumen and knowledge of university predicaments and also of his generosity of spirit. I hope that we shall continue to earn his praise in those matters where we are already entitled to it, and shall make greater efforts to deserve it where we are not. After all the points which he has selected for his commendation of us are essential and vital. They are among the minimum qualities without which universities cannot live.

When we come to the criticisms we find that Professor Kneller has been greatly affected in his study by the controversies that have arisen around Sir Walter Moberly's *The Crisis in the University*. His concentration on the literature on this matter is made quite clear by his bibliography, and he makes no bones about his views of it. He thinks very little indeed of British thought in this field. There is a crisis in the British university because the whole attitude to the choice of subjects to be taught and to the teaching of those subjects is wrong – antiquated, traditional, *a priori*, pigheaded, and wrong. 'We have already mentioned the inadequacy of the Livingstone school, which is essentially and unrelievedly literary and retrospectionist. . . . Commentators of the stamp of Livingstone, Leavis, Moberly, Nash, H. A. Jones, Niblett, Jeffreys, the Student Christian Movement, and, to a limited extent, Clarke, should understand that it is dangerous to advance any sort of philosophic, theological or religious dogma without exploring beyond the actual sphere in which such dogmas are formulated and tested. . . . Scientists, too, can advocate faulty educational theory; Professor Oliphant, for example, wants unity in knowledge and states that the quality of the university has been enhanced not by applied science but by a study of the pure sciences'. All is gloom, almost wilful gloom. I do not think Professor Kneller finds a single candle throwing its little beam from this naughty world. The fault is evidently a national one. Or perhaps it is old Europe.

Of course he does not think the universities are as bad as all that, even in regard to their curricula, which he believes is their weak spot and at the base of all their shortcomings. But he does think that our approach is fundamentally wrong. It is an old controversy between the old and the new worlds; and Professor Kneller gives in general lines the old answer. Not enough account is taken of modern scientific advances. In particular the psychologists and the sociolo-

gists have established a body of knowledge which could throw a blinding light on the right principles of education for the modern man; and it is perverse of us not to recognize this. 'The so-called educational fundamentals as defined in modern commentary, as well in Britain as elsewhere, are far too trite and nugatory in the light of what modern specialists in biology, anthropology and psychology reveal on human life and living.'

Professor Kneller's countrymen have often told us before that we ought to have learned from the biologists and the social scientists something sure and certain which can automatically make our modern education as much better than old education as our new science is better than old science. He is quite right in saying that we are still far from being convinced either that there is much truth in this particular view or that there is much value in barking up this particular tree. Many of us in Britain today believe that the best American universities have some educational secrets which ours do not have; but I do not believe that Professor Kneller's answer gives the clue to them.

C. R. MORRIS

The Revolution in Philosophy. A. J. AYER, W. C. KNEALE, G. A. PAUL, D. F. PEARS, P. F. STRAWSON, G. J. WARNOCK, R. A. WOLLHEIM, GILBERT RYLE. *Macmillan*, 10*s.* 6*d.*

Contemporary Philosophy. FREDERICK COPLESTON, S. J. *Burns & Oates*, 18*s.*

The Revolution in Philosophy is the result of collaboration between eight contemporary philosophers – three of whom may justly be said to have played a significant part in the revolution that the book describes. The papers (broadcast in the Third programme) are now printed as chapters of a single book. And with propriety: there is in nearly all cases a full awareness by each writer of the part he is playing and of the parts assigned to the other symposiasts. Each preserves his own personal style: each is clear and unpretentious. The movement described is the emergence of what is now generally called 'the so-called "Oxford Philosophy" ' – a movement which took place at Cambridge. The team assembled includes A. J. Ayer and R. Wollheim from University College, London; Gilbert Ryle, W. C. Kneale and four others, all of whom are now teaching at Oxford. In fact, only one member is not Oxford by origin, George Paul, whose two

papers (on Moore and Wittgenstein) alone convey the real flavour of the Cambridge debates of the 1930s in which he played a part.

The movement is commonly said to have begun at the turn of the century, with Moore's rejection of Bradley. In his *Appearance and Reality* and in his *Logic* Bradley rejected all commonsense and scientific beliefs as being mere appearances. Reality (if it could be described at all) would have to be described as One. All this Moore discarded: but as Wollheim shows, Bradley's work made analytic philosophy possible in a positive way. For it was Bradley who turned aside from Mill's psychologism and brought philosophy back to the central notions of truth and reality: and it was Bradley who initiated the analysis and criticisms of *judgments* in place of the quasi-psychological analysis of ideas. Frege, also, is claimed as one of the forerunners, since he first undertook an analysis of arithmetical notions into purely logical terms and set forth the ideal of the perfect logical language.

The main stages and divisions of the movement are clearly traced. The analysis of propositions is of course opposed both to Bradley's scepticism and to his monism. One might perhaps say that Moore especially opposed the scepticism (in defence of commonsense beliefs) and Russell especially opposed the monism (in favour of logical atomism). The first system to emerge is Logical Atomism (Russell 1918, Wittgenstein 1921: here discussed by D. F. Pears). It is a metaphysics which is both the result and the justification of reductive analysis. The difficulties and paradoxes of this view, as set out in Wittgenstein's *Tractatus Logico-Philosophicus*, led philosophers of the Vienna circle to propound a second system, Logical Positivism. They rejected metaphysics altogether (while continuing to practice logical analysis) and put forward the Verification Principle as an over-all criterion of meaningfulness. The stages of this second movement are sketched in a trenchant but very fair account by Ayer, whose own early work (1935), first introduced Logical Positivism into England. Meanwhile one might say that Moore's defence of commonsense beliefs (1925) and his practice of analysis were leading him to something very different from both Logical Atomism and from Logical Positivism. To the view that there is nothing wrong with ordinary language or common usage except that it is very difficult indeed to understand – that in trying to understand it we must not appeal to any invented language but to language as it is actually used. Moore was inspired 'to stand firm for any merits the common tongue may

possess' as well as for the certainty of commonsense beliefs. Wittgenstein's teaching at Cambridge marks another stage in the story:

> He follows Moore in the defense of commonsense and in a regard for our ordinary language; but criticizes the notion of *analysis* in a way that has quite changed philosophy.

Analysis, as practised by Moore, presupposes that language always functions in one way – always serves the same purpose – sometimes clearly and sometimes very obscurely. This is a picture of language which hides the reality: it is a dead-end in philosophy. In reality language functions, and functions effectively, in very many different ways. The task of the philosopher is to try to resolve the difficulties which arise when we try to think *about language*. Philosophical perplexity is perplexity *about language*: the task of the philosopher is to resolve the perplexity simply by an examination and description of those features of ordinary language which happen to perplex. This view of philosophy has been called *therapeutic*.

Paul's short but extremely suggestive account of Wittgenstein's later teaching might have been the last word in this book. But no: Strawson and Warnock do not stop there. They have something to say for the methods of Carnap and Quine – the construction of artificial language-systems: and they are prepared to say that the tasks of philosophy are not wholly therapeutic. The examination and elucidation of ordinary language can (they hold) be done systematically and for its own sake. They also say that it is possible not only to describe ordinary language but also to *explain* how it comes to contain the concepts it does contain. (I am not sure that this sort of explanation would have been rejected by Wittgenstein: it seems to be achieved by characteristically L.W. technics.) As they both realize, this programme will not command general agreement: I suppose that the reasons against this view involve one's whole notion of what philosophy is – reasons which have been set out with great power and insight by John Wisdom. The truth seems to be that Wittgenstein's notion of what philosophy is, is not really accepted and is not being discussed. Neither Strawson nor Warnock makes any reference to Paul's chapter on Wittgenstein. And I do not think I agree with Warnock that nothing really turns on this question except the application of a name.

One might add that the book does not attempt to discuss fully inquiries into ethical judgements; and that the last chapter, 'Ana-

lysis and Imagination', is not about the imaginative uses of language. But, within its limits it is valuable not only as an explanation for those who are not engaged in philosophy, but also as a work of assessment and recapitulation for those who are or ought to be.

An account of the position of philosophy in this country is also given in the first two 'chapters' of Father Copleston's collected papers, *Contemporary Philosophy*. These first two papers were addressed to the Roman Catholic world and give an elementary account of the phases of development which the movement has undergone. The earlier paper, published in 1950, was surely very much out of date at the time when it was written. Of much higher quality are the papers on metaphysics and verification which were addressed to the readers of *Philosophy* and *Mind*. The key to his conception of metaphysics is given in an address entitled 'On Seeing and Noticing': there is after all an 'intuition of being' which consists in *noticing* that something which we all *see*, does exist and might not have existed. In a paper on 'The Meaning of the Terms Predicated of God', Copleston argues that statements about God may be meaningful in the sense that they are not compatible with every alternative statement. He is throughout concerned to defend metaphysics against criticisms based on the Verification Principle: and to combat crude empiricism and positivism without denying the value of linguistic methods in philosophy. Sometimes his attack seems to be against positions never occupied: but one sees him also discovering for himself important objections which have already been admitted elsewhere: e.g., that the theory of 'logical constructions' is itself a metaphysical theory; that philosophy cannot be concerned with this or that language but rather with the analysis of concepts; that one cannot settle the meaning of a philosophical utterance without seeing what led the philosopher to make it and what he wants to do with it.

It will be seen that Copleston has taken up the role of the Go-Between. And in the second half of his book he offers an account of continental Existentialism and Personalism. He comes to the conclusion that these philosophies are important because they lead us to *notice* features of our situation in the world – features which everyone cannot help but *see*: in this way they give rise to genuine problems which are passed over in silence both by rationalism and by positivism. The point of raising these problems is not simply to brood upon them or to air them dramatically: the real point is to try to solve them. Copleston's exposition, though often slipshod and

repetitious, always *aims* at clarity: and his criticisms are beautifully sane. Readers who feel at home in the climate of *The Revolution in Philosophy* can be recommended to try these lectures on Existentialism. It will be a change of air.

KARL BRITTON

D. H. Lawrence: Selected Literary Criticism, *ed.* ANTHONY BEAL. *Heinemann*, 21*s*.

Interpretations: Essays on Twelve English Poems, *ed.* JOHN WAIN. *Routledge & Kegan Paul*, 25*s*.

Lawrence's *Studies in Classic American Literature* (1923) and *Phoenix*, the edition of his uncollected and unpublished prose made in 1936 by Edward D. McDonald, have long been difficult to get hold of, and there are no signs of the latter's being reprinted (the former has just reappeared in England in Edmund Wilson's compilation *The Shock of Recognition*). Mr. Beal's collection, drawn with two exceptions from those volumes and from Aldous Huxley's edition of the *Letters* in 1932, is therefore very welcome. From the 'Literature and Art' section of *Phoenix* 27 of the 40 pieces are reprinted, from *Studies* eight essays of the twelve, and the total of 104 items is then made up mainly by extracts from letters. The long 'Study of Thomas Hardy' is severely cut down; as is 'Introduction to these paintings', which in curtailment by two-thirds loses the great comments on Cezanne—understandably in view of the title of the collection, regrettably in that they are surely more worth having than the doubtful speculations as to the incidence of syphilis among the Tudors and Stuarts and its effect on English literature. Only two of the other pieces are cut, but both rather unfortunately; the short piece 'The Ningtingale' being misleading without its first half, and 'Chaos in Poetry' being robbed of its comments on Crosby's poetry – comments whose interest should not have been assessed at the now low valuation of that poetry. Room might have been made for the 'Duc de Lauzun' fragment – if its companion 'The Good Man' was to be given, and one misses the interestingly autobiographical preface to McDonald's *A Bibliography* and the similarly interesting discarded preface to Lawrence's *Collected Poems*, both available in *Phoenix*. In other respects the selection is wisely made, and with the *Letters* announced for re-publication (and *Phoenix* not) it is one very

well worth having. Lawrence discusses morality and the Novel, and the purpose of the Novel, and brings his general views to bear on Wells, Galsworthy, Thomas Mann, Dostoievsky, Poe, Hawthorne, Melville, and Maugham, among others, with incidental remarks on, for instance, Bennett, Joyce, Proust, and Aldous Huxley. And vigorous the comment is; often in a jeering, heckling way, and usually fiercely assertive. The reader who expects criticism to be polite, urbane, 'impersonal', and to aim at or assume the guise of 'objectivity' will find here much for his discomfort.

Literature for Lawrence was not an academic question or a hobby. For him, 'the essential function of art is moral. Not aesthetic, not decorative, not pastime and recreation. . . . But a passionate, implicit morality. A morality which changes the blood, rather than the mind.' As a critic, he was a moralist, as (though in no crude or merely technical sense) all worthwhile critics (however 'aesthetic') must be – and if they are not to be, what purpose in any criticism beyond the Spot-the-Winner, Guide-to-the-Shows type of newspaper review? The important message of his pieces on the Novel in general is that novels have effect by forming and nurturing sentiments rather than by serving open and explicit precepts on the reader, and that the validity of the imaginative proposition that a novel is has some importance. To accept this as a fact of aesthetics entails no concurrence in Lawrence's distrust of mental consciousness.

Much in this volume bears the mark of the occasional, of the review; many of the extracts from letters, as all such, merely show how a novelist of great sensitivity and earnestness felt about his contemporaries (and rarely does posterity endorse *all* such opinions of the one man); there is often a wearisome tub-thumping, often a most strange eclectic mysticism. For all this, there is not merely evidence of great critical penetration, there are complete particular critiques of a most challenging kind. In an essay on Melville, for example, the aptness to *Billy Budd* of his summing-up is striking – yet, at the time of writing, *Billy Budd* was still unpublished. Probably the American studies best show Lawrence's critical force – even if one questions his way of taking fictional events as facts of spiritual history.

Yet his critical writings will look somewhat old-fashioned to a reader distrustful of talk about plot and characters, and of bold generalization; to one intent on the 'texture' of the writing, as any reader schooled in the 'thirties is likely to be. By then the call to 'practical criticism' had sounded, and 'practical criticism', more a

principle than a 'method' (though often employing the inevitable means of comparison and contrast), was an endeavour to inculcate accurate and responsive reading, and discrimination with regard to our mental fare from its first point of impact on the mind: it was an educational process at heart and necessarily focused sharply on detail.

It is because of this movement that *Interpretations* is so entirely different in approach from almost anything of Lawrence's. Unfortunately this is not the only reason for differences.

Interpretations, the blurb tells us, is 'an extended exercise in practical criticism'. As 'reading a poem is an activity at which it is possible to succeed or fail,' says Mr. John Wain, the editor, in his introduction, he has asked a few of the 'younger critics' (but 'critic', I suggest, should denote an order of merit rather than a trade) 'to demonstrate what they mean by "reading".' The result is twelve essays by 'younger' teachers and journalists on poems (printed in full) ranging from Shakespeare to Yeats, plus an epilogue, 'On the Interpretation of the Difficult Poem', by Mr. G. S. Fraser. There is no common platform, no party line: each simply does his utmost with his chosen poem; and, Mr. Wain explains, 'thanks to [an earlier generation], a man writing an analysis of a single poem is not thought to be acting queerly.'

Mr. Wain has, I think, misled himself, and others too. 'Practical criticism' is something other than this, and deserved better than it. Not that there is nothing interesting in the book. There is, in fact, a good essay on *Resolution and Independence* by Mr. W. W. Robson; Mr. L. D. Lerner on Marvell's *Horatian Ode* has much that is penetrating (despite his fantastic description of the poem and the poet as 'Marxist'); Mr. Wain is perceptive and not uninteresting on the Yeats poem (though at one point he over-confidently sacrifices the poet's intentions to his own requirements); and there is a lucid commentary on *Prufrock* by Mr. Margolis (marred by an important over-measurement of the 'dramatic' element – *does* Prufrock 'actually compose a short set of verses'?). Mr. G. Martin is sound (if commonformish) on Macbeth's 'If it were done' speech, and there is fresh evidence of Mr. Donald Davie's powers and knowledge – here misapplied, one feels, through some mistaken notion of a Practical Criticism 'method', for instead of boldly claiming for Bryant the virtues of simple statement and honest faith, he tries to leave a respect for them washed up, as it were, after coming down firmly on the vagueness and uncertainty of the poem; while Mr. D. E. Ward's

essay on *The Windhover* suffers from the fact that so much has been written about the poem – one seems to have read most of it before, and it has not the justification of conclusiveness. But this is a small bag from a 25*s*. book as self-importantly presented as this is; and to wrestle further with detail would be to take the volume too much at its own valuation. A review, after all, is something other than the patient marking of student essays – however talented and diligent the writers.

The question is: for whom is the book intended? One would suppose, the university or (less certainly) school teacher of literature, and perhaps the occasional literary journalist. Yet these one would suspect to be capable of equally or, mostly, more successful reading themselves. Moreover, these are not the audience intended. The aim, Mr. Wain tells us, is to establish that 'to read a poem critically . . . is not really an impossible ideal, something to be left to the specialist, but an activity that any sensible person can hope to train himself for, with not much more than his native honesty and vitality.' Here are some extracts:

> Any unfolding, however intensely linguistic, is a series of actions, and the action of language is expressed clearest through the moods of the verbs used. In the opening section all these are imperatives. The authority of tone sets the poem in motion and creates a fitting atmosphere.
>
> *Let the bird of lowdest lay*
>
> The heavily stressed imperative and alliterating superlative give the poem a great push forward into a rhythmical buoyancy which it never loses. It is this that gives the confidence which guides the poem through the badly mapped country of speculation, and helps the sureness of its final affirmations. But the imperatives also include a number of words of command. . . .
>
> The birds rest 'to eternitie', in a final resolution of chastity and theology. . . . In the end Christianity, wit, metaphysics and poetic device are assimilated in to the mystery of 'married Chastitie'; they all rest in the calm of a delicately, but logically and passionately attained sense of proportion.

On Lionel Johnson's

> Dark Angel, with thine aching lust!
> Of two defeats, of two despairs:
> Less dread, a change to drifting dust,
> Than thine eternity of cares.

. . . it seems certain that the defeats are the metaphysical Fall and the Cross, while the despairs are deprivation of God and deprivation of

death. Lucifer fell by pride and would rise by the same passion. (Suarez in his 'De Angelis' suggests that Satan desired a hypostatic union with God, in the manner of Christ's hypostasis. Aquinas, anticipating this speculation, objects that, for Satan, this would be tantamount to wishing to cease to be, and no one can purpose that in a metaphysical sense. This hypostasis is the counterpart of the dialectical relation between shadow and waking self, the urge of the Unconscious to assimilate the Conscious.) In such a context Johnson's reference to 'drifting dust' becomes considerably pointed.

Can Mr. Wain really believe that 'any sensible person', with no matter how much 'native honesty and vitality', could, or would, hope to train himself for such an inflation *ad absurdum*? – or that he ought to be encouraged to?

Reading closely, criticizing fastidiously, will often produce a throng of associations and alternatives, even a roundaboutness, of paraphrase, whether in private pondering or in the almost equally fleeting, if more fully verbalized form of a classroom or seminar, where a teacher attempts, as it were, to massage a poem into full, flexible motion in his companions' minds. Tact and judgement can make even an elaborate analysis of *selected* points acceptable in a written study. But the solemn inventory of detail tolerable in conditions of evanescence and when regulated by the nature and quality of the poem and by the reactions of companions, the almost limitless spinning-out of reference suitable, indeed, valuable in editorial annotation, are very hard to justify without some relation to a progressive thesis or some provocation to dispute. This *is* to make literature an academic question.

Much of this book, however, would be regrettable in any conditions. Mr. Wain admittedly remarks: 'As the editor of this collection I am inclined to be modest about it: the essays strike me as uneven in quality, and I should be far from claiming that anyone's critical problems were going to be solved by the book.' I am much deceived if an editor can get out of his responsibilities by any such bland disclaimer. Something ought to have been done to make all the manifest effort useful: to judge from the signs of considerable academic gifts betrayed by the contributors, something, indeed, could have been done. As it is, I am reminded of the misdirection of energy celebrated in the old parody of the 'Teach yourself' advertisement: 'They laughed when I sat down to the piano. BUT THEY WERE RIGHT – I *couldn't* lift it!' Though some of the contributors can, and do.

F. N. LEES

The World of Odysseus. M. I. FINLEY. *Chatto & Windus*, 15*s*.

The sociological approach to the Greek and Roman classics is now fashionable. In a very readable book Mr. Finley has interesting things to say about wealth and labour, about household (*οἶκος*), kin and class, and about the elementary political structure in the world of Odysseus. At any time for the last eighty years or so the word *οἶκος* would have been the cue for an architectural disquisition. But for Mr. Finley *οἶκος* is a sociological term. His concern is with the social structure implied by the *Iliad* and the *Odyssey*, and he brings us cheering news about it. He is convinced that, viewed by a trained eye, it affords an essentially coherent picture. This picture he paints in broad colours.

Trade and commerce being as yet non-existent or in the hands of the Phoenicians, all wealth was drawn from the land. Most of the land was divided up among the great households, the aristocratic heads of which were called kings. The members of the household were their kin, their retainers (*θεράποντες*) also belonging to the noble class, and the numerous slaves, male and female. Outside the great households there was a free population of small individual holders of land, herders, and craftsmen. Lowest of all were the property-less labourers available for hire when needed. This society was static, for marriage was class-bound and there was, as yet, no new source of wealth.

There was no currency, but, apart from barter and distinct from it, there was a ceremonial gift-giving among the nobility, governed by strict etiquette, on which the prestige of the noble and his relations with other great houses depended. In the store-room of every great house, in addition to the consumption goods distributed for the maintenance of the household, there was a supply of valuables – unwrought metal, metal wares, fabrics – to maintain this ceremonial exchange. These exchanges were used to establish relations of guest-friendship with nobles not of the same kin, and these guest-friendships took the place of the later political alliances between states. At the same time a community of a larger kind than the household had grown up. Heads of households in the same locality would meet in the *ἀγορά* (which at this time meant place of assembly and not market-place) to discuss matters of common interest. Such political communities were ruled by a king of kings, distinguished from the lesser kings by the descriptive phrase 'ruling by might'.

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This in outline is what Mr. Finley has to tell us. There is not, perhaps, much that is really new, but the picture is firmly drawn and, I should say, correct in the main; nor would it be easy to find elsewhere a brief presentation of the subject that is more attractive and helpful than this. Certain queries and criticisms, however, do suggest themselves.

First, it is surely legitimate to doubt whether all land was at this time individually owned. The argument for the survival of communal ownership given by Professor George Thomson (*The Prehistoric Aegean*, chap. viii) is not answered by being ignored. It has, on the contrary, been rendered more probable by Professor Palmer's deduction from the Pylos tablets (*Achaeans and Indo-Europeans*, 1955) that Mycenaean society fell apart into the two great divisions of 'men of the feudal service' and 'men of the village land'.

Again, too little is said about the upper and lower limits in time suggested by Mr. Finley for 'the world of Odysseus'. He is emphatic that there is very little reflection of Mycenaean Greece in Homer. In his view the *Iliad* was composed about 750 B.C. and the *Odyssey* about 650 B.C., and the world they reflect is said to be that of the tenth and ninth centuries. But, granting that the glories of Mycenaean Greece were over, we may wonder whether the basic social conditions – the source of wealth, the ownership of land, the structure of the household, the division of classes, the institution of guest-friendship – differed greatly in the two periods.

There remains the question of the lower limit in time. Here Sir Maurice Bowra, in a generally helpful Foreword, provides an obstacle to understanding. He interprets Mr. Finley to mean that the *Odyssey* is 'a living record of social conditions at the time when it was composed'. Mr. Finley himself several times states the contrary. On page 35, for instance, he says: 'The poets of the *Iliad* and *Odyssey* were basically neither personal nor contemporary'. He regards the emergence of the πόλις as marking the end of the world of Odysseus. But we could do with much more discussion of this and other points.

For the fact is that Mr. Finley achieves his great readability by the employment of rather summary arguments. His book has the inconvenience of presenting new conclusions of research in an extremely popular form. This determines the character of the bibliography. His references to his Greek sources are, indeed, full. But, as regards modern literature, he avoids in the main not only books in foreign languages but even English books which require

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'expert acquaintance with Greek history and its modern scholarship'. The latter limitation, he tells us, excludes even such a book as Wade-Gery's *The Poet of the Iliad*. The former limitation excludes, I note for myself, Severyns' *Homère*.

These two books – both of which, incidentally, scrupulously consult the convenience of the Greekless reader – contribute much by their special expertize to defining the all-important difference between the two worlds, the world *of* which Homer sang and the world *for* which he sang. The bards in the *Odyssey*, Phemius and Demodocus, sang at banquets in the halls of kings. Homer, perhaps, gave an occasional performance in the houses of the great, but his normal audience was the people. Wade-Gery brilliantly reconstructs for us the conditions in Ionia which produced Homer's audiences. They were found in the great assemblies (*πανηγυρεις*), gathered from many cities and lasting several days. The Alexandrian critics, of course, already sensed the presence of this new audience in the Homeric poems, but nobody, I think, has explored it so sensitively and so successfully as Severyns. Laying down the general proposition that the similes in Homer evoke the contemporary world of the poet, he invites us to look again at the two hundred and forty similes, amounting in all to some eight hundred verses, and to find in them Homer's world and Homer's audience. The experience is convincing. Take one example. There are thirty lions in the similes. Not one of them is being hunted by the nobility for sport. All are the enemies of the little people, prowling round their sheepfolds and their cattle stalls and being beaten off by shepherds and cowherds. Gradually, as one reads, the difference between the two worlds asserts itself and leads to a decisive judgement on the meaning of the two poems. Mr. Finley is hasty in speaking of 'Homer's indifference to the common people' and in claiming that 'Homer spoke for the aristocracy'. There is more subtlety in Severyns' conclusion: *Aristocrate par son oeuvre, Homère était, pourrait-on croire, de modeste naissance; il était, à coup sûr, un grand ami des humbles.*

B. FARRINGTON

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Welcome new features in the thirty-third issue of the *Year Book of the Universities of the British Commonwealth* include an analysis, in most of the separate university entries, of the distribution of students by faculties. In an age of digests this takes the place of 150 university calendars. Its exhaustiveness makes it an essential in any Faculty or Senate Boardroom, and an indispensable in the common-room. For the academic politician here is an armoury of fact, ranging from admission requirements to every university in the commonwealth, to the types of vacation courses offered therein. For the gossip here is conveniently indexed the location, status and qualifications of 36,500 professional colleagues. For the desultory reader the mere turning of the 2,000-odd pages kindle an interest in the faculties and facilities of any commonwealth university that strikes his fancy. For the sociologist it is a rich quarry, often with blocks ready hewn, like the statistical analysis of overseas students at universities in the U.K.

It has earned its place on the bookshelves beside Crockford and Burke, and, like them, is diverting in its richness. Who would believe, for instance, that there are no less than 484 special types of degree qualification that can now be earned in the Commonwealth? Some have tantalizing associations. What, one wonders, is the demand for the degree of M.P. (Master of Planning) or the B.Or. (Bachelor of Orientation)? Perhaps it is an index of our outlook that at present neither of these progress to a Doctoral qualification.

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cey, Carlyle and others created a public for that language; or with that of Russian before the great translators. We have had, of course, a number of very important studies and translations from academic writers, among them Professors Dawkins, Mavrogordato, Jenkins, Stanford, Trypanis and Bowra; and a number of fine translations of novels by Venezis, Theotokas and Kazantzakis. The little volume of essays and poems in English by Kapetanakis which John Lehmann produced in 1946 has been influential and is quoted in the most unexpected places. But as yet there is no general understanding of Greek experience and its place in 'the mind of Europe'. Indeed, Kapetanakis, in one of his impressive English poems, was obliged to counter with astringent irony all the inappropriate expectations represented by the poem's title, *The Isles of Greece.*

> The sun is not in love with us,
> Nor the corrosive sea;
> Yet both will burn our dried-up flesh
> In deep intimacy
>
> With stubborn tongues of briny death
> And heavy snakes of fire,
> Which writhe and hiss and crack the Greek
> Myth of the singing lyre.
>
> The dusty fig-tree cries for help,
> Two peasants kill one snake,
> While in our rocky heart the gods
> Of marble hush and break. . . .

The whole poem – there are two more stanzas – is one of the few fine poems of the last war. Irony is certainly part of Greek experience, which the events of every day only deepen, and there is an almost oppressive sense of antiquity which cannot be eluded for it is the root of our common history and religion. But there is also a wonderful lyric quality which readers may have found in the English translations of Venezis' and Kazantzakis' novels. There are not a few Greek novels which give a masterly impression in the original and would probably survive translation. The long Cretan novel *Kapitan Michael* by Kazantzakis combines all the power of Verga with a greater sophistication and sense of tragedy. Its translation would add as much colour to the contemporary scene as the discovery of an unpublished novel by Emily Brontë. Another writer, Angelos Vlachos,

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has written a scholarly interpretation of the life of Alcibiades in the form of a novel, which becomes that rare thing amongst historical novels, an exciting commentary on modern politics. The same author has written a fine account of the Albanian campaign based on his own experiences. We have heard far too little of the experiences of the Greeks during the Italian campaign and the German occupation, though we have had rather a surfeit of reports from other quarters. And translation of such a war novel as Akritas' *Armed Men* would be its own justification. Mr. Zalocosta's account of the German occupation, *The Chronicle of Slavery*, deserves a distinguished place in the grim library of such writing, and is a most interesting – one would say a valuable – analysis of allied policy or lack of policy towards Greece during the war years. On the whole a much more continuous interest in Greek literature has been shown by the French, the Germans, the Swedes and others, than by the British public, and it would not be easy to suggest reasons why this should be so.

In this volume Mr. Philip Sherrard inevitably challenges comparison with M. Samuel Baud-Bovy's *Poésie de la Grèce Moderne* (Collection Culture Européene, Lausanne 1946) and with M. Robert Levesque's essays and translations in the collection *Permanence de la Grèce* (Cahiers du Sud 1948), and his volume of translations of the work of Seferis. Whereas these works in French are mainly descriptive, Mr. Sherrard's book shows that he is much more positively drawn towards the poets who are the subjects of his essays: Solomos, Palamas, Cavafy, Sikelianos and Seferis. This positive attitude produces excellent results in all the essays with the exception of that on Cavafy, where it produces simplification and distortion. It is not really possible to make an ally of Cavafy any more than of Baudelaire. He is not likeable. It is much better to recognize, as Mr. Forster did, that he is a complex historical fact, and that his sensibility is a fact which must be taken into account and must modify the 'ideal order' which Mr. Eliot once wrote about.

By pointed summaries of theme and by translation, Mr. Sherrard overcomes the difficulty of establishing a subject-matter to be understood and discussed. This is an important service. Wisely, he does not attempt to decide whether his poets are major or minor, and gets on with the task of telling us what he sees. He sees resemblances in the kind of poetry written by four of the five, and considers that Cavafy 'lies outside the main stream'. He argues impressively that

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there is such a stream of poetic tradition. 'The work of these four poets is of the same type, and springs from an understanding of the poet's function that is common to all of them. The poetry is, above all, mythological. It is concerned less with the small data of sensory observation or the memory of natural experience, than with the inner nature of life. The poetry has something of the function of ritual drama; and the poet regards himself less as an individual expressing himself than as a mystagogue, a psychopompos, whose concern is through his poetry to communicate an awareness of an underlying pattern in life, the knowledge of which will help his readers towards personal fulfilment.' This is interesting and probably true of all these poets. It is a pity therefore that Mr. Sherrard should have thought it necessary to force a portentous contrast between this tradition and that of Western Europe. He does not make clear in what way the aims of a Palamas differ from those of a Wordsworth or a Yeats. Would not the quoted passage apply to their work also? Yeats would seem to be in many ways a poet in terms of whom a Sikelianos or a Solomos might be understood. The effectiveness of Seferis' translation of 'The Waste Land' also implies real affinities. Mr. Sherrard claims for Greece an unbroken poetic or mythopoeic tradition which elsewhere was interrupted by the intellectual habits of what we now rather tentatively call 'the Renaissance'. Here there seem to be echoes of Mr. Eliot's 'dissociation of sensibility', or of modern studies of the English Romantics. One would not deny the tenacity and the significance of continuities in Greek life, especially in folklore, in folk-poetry and in religion. The title of the book is taken from a ballad describing the struggle of man with Death – 'O Charon, let us wrestle on the marble threshing floor'. There is so much in Greece to waken even the dullest and most sublunary sensualist into a consciousness of spiritual powers. But Mr. Sherrard's claims are too large for the evidence that he adduces on this occasion. It is to be hoped that he will continue his work of interpretation and his amassing of evidence, and that he will put more of his sensitive translations before the public. Translation is perhaps the only persuasive way of advancing a thesis such as that of these promising essays.

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